MUSIC - UNIVERSITY OF TORONTO
3 1761 04879 3194

# The Organ

ed from within.

ML
552
B76

on and
on, with
th Chap-
MAS LEWIS
drawn to
Working Drawings, to-
rams, Tables, etc. 4to, extra gilt, cloth,
oth, 15s. 6d. *net*.

By C. F. ABDY-WILLIAMS, M.A., Mus.Bac.
pters, 38 Illustrations and Photogravure
endix containing: Two Instruments found
. W. Galpin's Hydraulus; Organ Builders;
erms; Bibliography and Chronological List
ions. 5s. 6d. *net*.

tory of. By C. F. ABDY-WILLIAMS, M.A.,
Chapters. Some Musical Examples, Photo-
e and Fourteen Illustrations of Title-pages,
d Portraits. Appendix containing: Musi-
ronological Synopsis of Organ Composers;
ollection of Organ Music. 5s. *net*.

RGANISTS. By J. T. FIELD. 3d. *net*.

Its History, Design and Control. By
ith folding Diagram. Second Impression.
paper, 1s. 6d. *net*).

**RGAN BUILDERS** and their Works, from
ry to the Period of the Great Rebellion.
er on the History of the Organ. By DR.
Well printed, with Woodcuts. Post 8vo,
per, 3s. 6d. *net*.

hensive Treatise on its Structure, Capa-
Bibliography. With Criticisms and De-
Consideration of General
By J. W. WAR-
Quebec. Four

s the un-
rk. The
s. The
ollect-
*sale*.

OAD.

# THE ORGAN VIEWED FROM WITHIN.

VELUT ARBOR ÆVO

*Presented to the*
LIBRARY *of the*
UNIVERSITY OF TORONTO
*by*

Mrs. N. Worrad

# THE ORGAN
# VIEWED FROM WITHIN

### A PRACTICAL HANDBOOK ON THE MECHANISM OF THE ORGAN, WITH A CHAPTER ON TUNING . . . . .

BY

## JOHN BROADHOUSE

*Author of "The Student's Helmholtz," "How to Make a Violin," etc.*

With Fifty-two Illustrations and Diagrams

WILLIAM REEVES
BOOKSELLER LIMITED.
*Second Issue*

83 CHARING CROSS ROAD,
—— LONDON, W.C.2. ——

LIBRARY
MAR
1982
UNIVERSITY OF TORONTO

ML
552
B76

Printed by The New Temple Press, Norbury Crescent,
London, S.W.16, Great Britain.

# CONTENTS.

PAGE

INTRODUCTORY ... ... ... ... ... ... ... 1

CHAPTER I.—WIND SUPPLY ... ... ... ... ... 7

CHAPTER II.—HOW THE GROOVES ARE ARRANGED ... ... 27

CHAPTER III.—THE PIPES ... ... ... ... ... 30

CHAPTER IV.—FROM KEY TO PALLET ... ... ... 42

CHAPTER V.—THE STOPS ... ... ... ... ... 48

CHAPTER VI.—THE STOPS *(continued)* ... ... ... 62

CHAPTER VII.—THE STOP ACTION ... ... ... ... 79

CHAPTER VIII.—THE PNEUMATIC ACTION ... ... ... 83

CHAPTER IX.—THE COUPLERS ... ... ... ... 87

CHAPTER X.—THE SWELL ORGAN ... ... ... ... 93

CHAPTER XI.—TUNING THE ORGAN ... ... ... ... 97

CHAPTER XII.—THE COMPASS OF THE ORGAN ... ... 104

CHAPTER XIII.—THE CASE OF THE ORGAN ... ... ... 108

CHAPTER XIV.—THE PITCH OF THE ORGAN ... ... ... 111

CHAPTER XV.—THE ELECTRIC ORGAN ... ... ... 115

# LIST OF ILLUSTRATIONS.

PAGE
Fig. 1. Blowing the Organ with the Feet ... ... 8
Fig. 2. Diagonal Bellows ... ... ... ... ... 8
Fig. 3. Horizontal Bellows ... ... ... ... ... 9
Fig. 4. Top Board ... ... ... ... ... ... 10
Fig. 5. Middle Board ... ... .. ... ... ... 10
Fig. 6. Bottom Board ... ... ... ... ... ... 10
Fig. 7. Action of Horizontal Bellows ... ... ... 10
Fig. 8. Wind-Trunks ... ... ... ... ... ... 11
Fig. 9. Tube to "Weigh the Wind" ... ... ... 17
Fig. 10. Front View of Wind-Chest ... ... ... ... 19
Fig. 11. Cross Section of Wind-Chest ... ... ... 20
Fig. 12. Sound-Board, with Fifty-four Grooves ... ... 22
Fig. 13. Slider In ... ... ... ... ... ... ... 23
Fig. 14. Slider Drawn Out ... ... ... ... ... 23
Fig. 15. The Table ... ... ... ... ... ... 24
Fig. 16. Arrangement of Pipes, 1 ... ... ... ... 28
Fig. 17. Arrangement of Pipes, 2 ... ... ... ... 28
Fig. 18. Arrangement of Pipes, 3 ... ... ... ... 29
Fig. 19. Vibrations in Open Pipe ... ... ... ... 36
Fig. 20. Vibrations in Stopped Pipe ... ... ... ... 36
Fig. 21. Reed, Open ... ... ... ... ... ... 38
Fig. 22. Reed, Closed ... ... ... ... ... ... 38
Fig. 23. Side View of Manual Key ... ... ... ... 42
Fig. 24. Side View of Pedal Key ... ... ... ... 43
Fig. 25. Key Action ... ... ... ... ... ... 44
Fig. 26. A Roller ... ... ... ... ... ... 45

PAGE
FIG. 27. A ROLLER BOARD ... ... ... ... ... 46
FIG. 28. WOODEN TRUNDLE STOP ACTION ... ... ... 80
FIG. 29. IRON TRUNDLE STOP ACTION ... ... ... ... 81
FIG. 30. PNEUMATIC STOP ACTION ... ... ... ... 82
FIG. 31. THE PNEUMATIC ACTION, CLOSED ... ... ... 85
FIG. 32. THE PNEUMATIC ACTION, OPEN ... ... ... ... 85
FIG. 33. THE "TUMBLER" COUPLER ... ... ... ... 88
FIG. 34. THE "SLIDING" COUPLER ... ... ... ... 90
FIG. 35. THE PEDAL COUPLER ... ... ... ... ... 91
FIG. 36. SWELL BOX, SHUTTERS CLOSED ... ... ... 95
FIG. 37. *(a)* SHUTTERS CLOSED; *(b)* SHUTTERS OPEN ... ... 96
FIG. 38. TUNING HORNS ... ... ... ... ... ... 99
FIG. 39. THE REED TUNING WIRE ... ... ... ... 101
FIG. 39*a*. SEMICIRCULAR TOWERS ... ... ... ... 109
FIG. 40. POINTED TOWERS ... ... ... ... ... 109
FIG. 41. A NICHE ... ... ... ... ... ... ... 110
FIG. 42. A "BREASTED" COMPARTMENT ... ... ... 110
FIG. 43. THE OGEE ... ... ... ... ... ... ... 110
FIG. 44. MR. WILLIS'S RELIEF PALLET ... ... ... ... 116
FIG. 45. COMPENSATING PALLET ... ... ... ... ... 116
FIG. 46. SECTION OF PNEUMATIC LEVER AND ACTION OF THROTTLE VALVE ... ... ... ... ... 117
FIG. 47. SECTION OF PNEUMATIC LEVER AND ACTION OF THROTTLE VALVE. BELLOWS DISTENDED ... 117
FIG. 48. MR. BARKER'S ELECTRIC AND PNEUMATIC ACTION ... 126
FIG. 49. THE ELECTRO-PNEUMATIC LEVER ... ... ... 128
FIG. 50. VALVE AND VALVE-SEAT, HOPE-JONES ELECTRIC ACTION ... ... ... ... ... ... 130
FIG. 51. CONSOLE, SHOWING THE INCLINED KEYBOARDS FIRST INTRODUCED INTO THIS COUNTRY BY ROBERT HOPE-JONES ... ... ... ... ... ... ... 132

# THE ORGAN VIEWED FROM WITHIN.

## INTRODUCTORY.

MOST people have seen an organist on his seat playing with hands and feet, pulling out and pushing in stop-handles, changing his hands from one row of keys to another, and so on, producing on the same organ sounds of all degrees of volume; and many have doubtless wondered by what means all these varying effects were obtained. The purpose of this book is to explain the apparent mystery; to show how the organ is constructed; to take the reader inside, and display to him, with suitable comments, the different parts of that exceedingly complex machine, the organ.

In general terms it may be stated that the tones of an organ are produced by the admission of draughts of air into certain pipes which the player wishes to speak. The wind is supplied by bellows, worked by a machine—sometimes by a human machine, who works up and down a long handle, so adjusted as to give him the greatest amount of leverage; in other cases, the bellows are worked by an inanimate machine, propelled by water-power or by a gas engine. The wind goes through wooden tubes, called wind-trunks, into a big box called the wind-chest, or into several such wind-chests. The wind in these wind-chests cannot get to any set of pipes until the player has pulled out the stop-handle controlling those pipes, nor even then, until he puts down one or more of the keys on the keyboard or on the pedal board as the case may be. The putting down of the key or keys pulls down, by intermediate mechanism, a "pallet," which keeps the wind from going into the pipe or pipes until the keys are put down by the hands or feet of the player.

This is a general description of the process which we will proceed to explain in detail.

The general operation of "playing the organ" may be thus briefly described:

The player takes his seat, with the "manuals" or rows of keys manipulated by the hands in front of him, and the "pedals," or keys played by the feet, below. These manuals are something like a pianoforte keyboard, but shorter, being usually limited to five or five-and-a-half octaves, as the tones produced by the extreme lower and upper octaves of the pianoforte are obtained on the organ in the lowest octaves by the pedal pipes, and in the highest octaves by pipes of a higher pitch than those giving the normal tones produced by the manuals.

These manuals range in number from only one on very small organs, to four or five on very large organs; and each manual controls pipes of different qualities of tone, as will be explained later on. On either side of the player, as he sits, there are a number of stop-handles standing out from the organ frame, with round ivory plates on them, giving the name of the particular row of pipes brought into action by the pulling out of that stop-handle. These stop-handles are within easy reach of the player's hands, and are also controlled, in certain groups or classes, by "composition pedals," moved by the player's feet. They are divided into as many separate sets as there are manuals, with, of course, a set added for the pipes controlled by the pedals. Thus, taking an ordinary three-manual church organ, there will be four distinct classes of stop-handles, or "stops," as they are called. On a three-manual organ, the manual nearest the player is always the "choir organ," the next above, or middle manual, is the "great organ," and the upper manual, the farthest from the player, is the "swell organ"; and the sets of pipes controlled by these three manuals, and also those controlled by the pedals, are brought into operation by the stops so labelled in the organ frame on either side of the player, who pulls out stops in either or all of the sets according to the pipes he wishes to "speak" when he puts down the manual or pedal keys.

The blower (mechanical or human) works the bellows to provide the wind; the player draws out his stops, and plays on one of the manuals with both hands (or with one hand on each of two manuals) and on the pedals with his feet. Suppose he has pulled out the following stops:

Great organ: Open Diapason, 8 feet; Flute, 4 feet.

Swell organ: Open Diapason, 8 feet; Oboe, 8 feet reed stop.

Pedal organ: Bourdon, 16 feet.

Now, by means of what are called "couplers," he can combine the above five stops in several ways. If he draws the "great to swell" coupler only, he gets the effect of the swell stops by putting down the keys of the great organ manual, and the bourdon stop on the pedal will speak by itself; or, leaving the "great to swell" coupler in, and drawing the "pedal to swell" coupler, every pedal note played will combine the bourdon tone with those of the open diapason and oboe on the swell, and the great organ stops will speak by themselves; or he can draw the "pedal to great" coupler, and combine the pedal tones with those of the great organ; or he can still further couple "great to swell" and "pedal to great," and thus obtain, by playing on the great with his hands, the combined tones of the two manuals, and by playing on the pedals with his feet, the combined tones of all three. The choir manual can also be coupled to either of the others, or to both of them, as well as to the pedals. Thus the player can, by arranging his couplers, get any of those exceedingly numerous combinations of tone-quality which are possible on a large three-manual organ.

The mechanism which connects the keys on the manuals and pedals with the various classes of pipes, will be explained in due course.

In considering, as a whole, the organ from within, we shall treat of the various parts in the following order:

THE BELLOWS.
THE WIND-TRUNKS.
THE WIND-CHEST.

The Sound-Board.
The Table.
The Upper Boards.
The Sliders.
The Claviers and Key Movements.
The Pipes.
The Stops.

# CHAPTER I.—WIND SUPPLY.

IN olden times the bellows of an organ were shaped like blacksmiths' bellows and were almost as clumsy. In Hopkins and Rimbault's monumental work on "The Organ," at page 35 of the historical portion, there is a curious picture, taken from Prætorius's work, "Theatrum Instrumentorum" (1620), of two men working organ bellows with their feet. Each bellows has a wooden shoe, and the men, hanging by their hands on a horizontal bar, are working a bellows up and down with each foot.

In course of time, however, this mode of "raising the wind" became insufficient for the requirements of organists, and mechanical methods of working the bellows came into use, as well as diagonal or wedge-shaped bellows, square or rectangular as to their top and bottom boards, but hinged at one end and

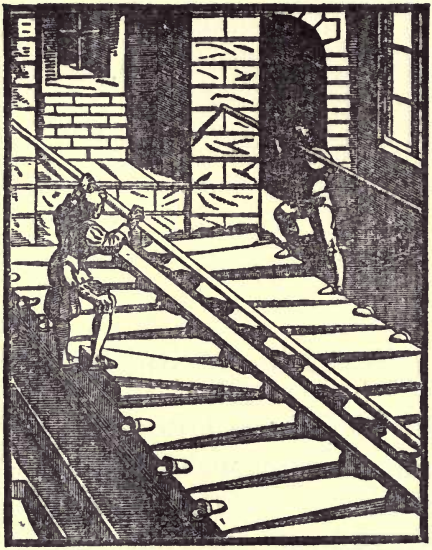


FIG. 1. BLOWING THE ORGAN WITH THE FEET.

worked up and down at the other. Fig. 2 shows what is meant by diagonal bellows.

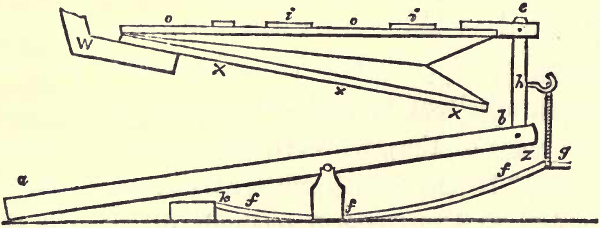


FIG. 2. DIAGONAL BELLOWS.

These were originally used in Germany, and are still largely employed in that country. In England

and France, however, what are called "horizontal bellows" came into use about the end of the eighteenth century, and in the beginning of the nineteenth century horizontal bellows came into general use, and their advantages proved so great that English builders now use no other kind. The difference is obvious: in the diagonal bellows only one end of the board rose while the hinged end was stationary; in the horizontal bellows the board rises as a whole. Whether full, empty, or partly full, the boards of the horizontal bellows remain in a horizontal position. The invention of this improvement in the wind supply is usually attributed to Samuel Green, a builder who flourished during the latter half of the eighteenth century; and horizontal bellows were first used in England by him in 1785.

The horizontal bellows consists of two chambers, one over the other.

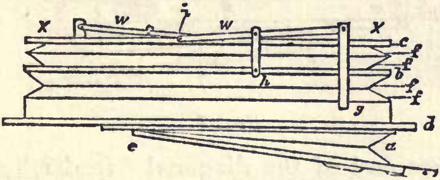


Fig. 3. Horizontal Bellows.

The lower chamber, *a*, which is somewhat like the old diagonal bellows, is the feeder, and supplies the upper chamber, *x*, *x*, with wind. This upper chamber is called the reservoir, and secures and supplies a steady flow of wind.

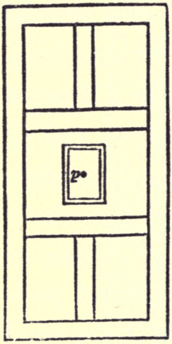


FIG. 4.
TOP BOARD.

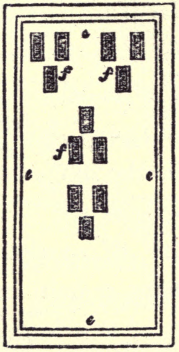


FIG. 5.
MIDDLE BOARD.

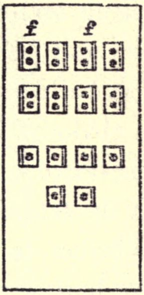


FIG. 6.
BOTTOM BOARD.

The action of the horizontal bellows may be thus briefly described:

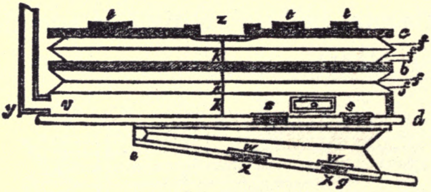


FIG. 7.

The free end of the diagonal "feeder," *g*, in the above figure, goes down, the outside air forces back the valves, *w*, *w*, in the bottom board, goes through the openings, *x*, *x*, and fills the feeder; the valves close in over the openings, and keep the wind in. The loose end of the feeder is drawn up, and presses the wind against the board above it, viz., the bottom side of the middle board. The valves, *s*, *s*, in the middle board are lifted, and the wind goes into the reservoir. The valves, *s*, *s*, then close, so as to hinder the wind from going back into the feeder. While all this is proceeding, the weights, *t*, *t*, *t*, on the top board, force some of the wind into the wind-trunk, *y* (see below for an explanation of the wind-trunks) to be carried to the part of the instrument supplied by this particular bellows; the top board falls as the supply of wind is decreased, and rises when more comes in from the feeder.

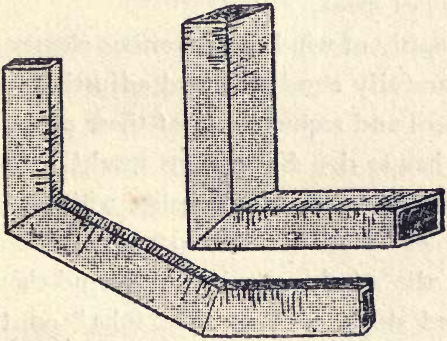
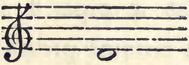


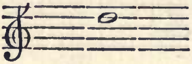
Fig. 8. Wind-Trunks.

The wind goes from the bellows into the wind-trunks, four-sided channels of wood, which convey it to the wind-chest for use. These wind-trunks are jointed in different ways according to the requirements of the particular instrument or the position of the bellows with respect to the wind-chests (Fig. 8). While the old diagonal bellows were used, there was only one chief wind-trunk from the bellows to the great organ wind-chest, with branches to the wind-chests of the choir organ, echo organ, and so on. But with the introduction of the horizontal bellows it became usual to have a separate wind-trunk right from the bellows to each wind-chest. The wind-trunks are made with as few bends, or "knees," as may be, for it is found that the more direct is the supply of wind from the bellows, the more promptly do the pipes speak.

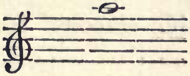
The supply of wind to the various classes of pipes wants carefully regulating and adjusting to the circumstances and requirements of those pipes, and the work it has to do. Some stops would not sound at all if the pipes were only supplied with the ordinary pressure of wind which comes from the bellows through the wind-trunk into the wind-chest. The loud reed stops, such as the "tuba" on the solo manual, are constructed with extra strong reeds, which require a proportionately stronger current of air to set them in motion. The "tuba" on the solo manual at St. Paul's Cathedral, for instance is on what is called "6-inch wind," an expression which I shall explain presently. Now, if this 6-inch wind or 6-inch pressure, were applied to an open diapason or any of the ordinary "flue-stops," they would be "over-blown," and would not produce their own proper note, but a note an octave, a twelfth, or even two octaves above their normal pitch. Try for yourself the effect of overblowing a common tin whistle, the bottom note of which (i.e., the note it gives with all the holes closed) is D. If you blow gently without opening any of the six holes you will get D:



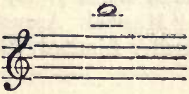
but if you blow harder you will get the D above:



and by blowing still harder, you can get the A an octave and a fifth above:

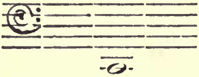


and sometimes even the double octave D:



Something similar to this would happen if an open diapason pipe were blown with as much wind as is required for a powerful reed stop—it would be overblown, and would give not its own note but one of its "harmonics." Therefore the organ bellows have to be "weighted," by putting slabs of iron or other heavy materials on the top board of the bellows. Even the ordinary flue stops require more pressure of wind than the unweighted bellows would afford.

The "harmonics" just referred to are produced, in a pipe, by causing the air to enter that pipe at a greater pressure than is necessary to produce the normal note of the pipe. It is a natural law, beyond man's control, that a pipe 8 feet long, when a current of air at a normal pressure is blown into it, will produce the note:



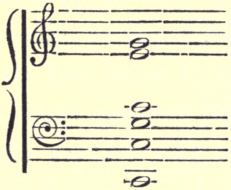
This is the normal note of an 8 foot pipe. It is not necessary to go into any very elaborate explanation of the scientific reasons* for this fact, beyond saying that the tone given by an organ pipe depends on the number of air vibrations per second in that pipe. Let us assume for a moment that the note C given, as above stated, by an 8 foot pipe, is the result of 100 vibrations per second. This is not actually the case, but round numbers will better explain the principle involved, without complicating the question. Then, taking 100 vibrations per second as necessary to produce the above note C at normal pressure of wind, a certain increase of that pressure will double the number of vibrations, and make them 200 per second, producing a note an octave higher. Further increase of wind pressure will treble the original number of vibrations, making them 300 per second, producing a note an octave and a fifth above the original C. Still further pressure of wind will quadruple the number of vibrations, making them 400 per second, producing a note two octaves above the original C. Thus it will be seen that every increase in the pressure of wind multiplies the vibrations per second of the air in the pipe by the numbers in the arithmetical progression two, three, four, five times, and so on, one representing the vibrations at the lowest pressure. The notes thus produced are the invariable "harmonic series" of the original or fundamental note, whatever may be the number of vibrations producing that note. This fact may be shown in figures, thus:

---

* For fuller information on the acoustic laws which govern the production of tone in organ pipes, the reader is referred to my work on "Musical Acoustics," published by William Reeves Bookseller Limited, 83 Charing Cross Road, London, W.C.

| | Multiplied. | | |
|---|---|---|---|
| Vibrations of original note. | Twice. Octave higher. | Three times. Octave and fifth higher. | Four times. Two octaves higher. |
| 100 | 200 | 300 | 400 |
| 150 | 300 | 450 | 600 |
| 200 | 400 | 600 | 800 |

The following will show, in musical terms, the results of increased wind pressure on the note C (assumed *pro tem.* to be 100 vibrations per second) above given as the fundamental note of an 8 foot organ pipe:



| Vibrations per second. | Relations to fundamental note. |
|---|---|
| 600 | Two octaves and fifth above. |
| 500 | Two octaves and third above. |
| 400 | Two octaves above |
| 300 | Octave and fifth above. |
| 200 | Oetave above. |
| 100 | |

All these notes can be produced from an 8 foot pipe by duly increasing the pressure of wind.

Now suppose the general run of the stops in any particular organ require a "3½ inches pressure," or "3½ inches wind," as the organ builder would say. He knows by the shape and quality of his pipes what wind pressure they require, and when his wind-chest is fixed, with the sound-board above it, he takes out one of the pipes and puts into the hole, where the pipe stood, a bent tube of glass containing water in the bend. The wind comes through *c* to the tube *b* at *d*. The wind-chest is filled from the bellows, and weights are put on the bellows until the pressure of the wind in the

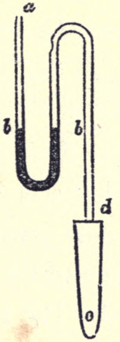


Fig. 9. Tube to "Weigh the Wind."

glass tube raises the water at *b* in the other limb 3½ inches. This operation is called "weighing the wind," and when the water has risen 3½ inches the builder knows that he has enough pressure of wind for the pipes which are to stand on that particular sound-board. If a 4 inches, 5 inches or 6 inches pressure is wanted, weights are added until the water in the tube of the wind-gauge rises to the necessary height.

When stops must be put on a greater pressure of wind than that required by the rest of the organ, they are placed on a sound-board of their own, and the wind is conveyed to a reservoir specially fixed and weighted under their own wind-chest. The pipes of the entire organ are thus put together in groups on different sound-boards, the wind for which is weighted as required, so that every pipe shall speak in its own proper tone and give just that quality of tone which the builder desires.

We have already heard something of the wind-chest, but we must now consider it in detail, and both as to the outside and the inside which contains much more than wind. The sound-board is a stout piece of oak of the same size as the wind-chest, on the top of which it rests.

Each row of keys is called a "manual," and each manual has its own separate wind-chest and sound-board; the pedal-stops have also their own sound-board and wind-chest, and every stop, whether on manuals or pedal, which requires more than the normal pressure of wind, has to be placed on its own sound-board and wind-chest and have its own wind "weighted," as above explained. Now let us see more in detail what the wind-chest and sound-board are like.

The wind-chest is a long and wide box, but in depth very shallow compared with its length and width.

Fig. 10 shows a front view (the board *l* in Fig. 11 being taken off), and Fig. 11 a cross section of the wind-chest. Through one of the ends, as at *a*, Fig. 10, or at the bottom (*c*, *c*, *c*, Fig. 11) is usually made the hole by which the wind comes from the wind-trunk to the wind-chest.

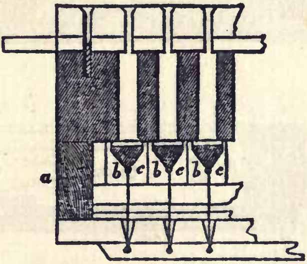


FIG. 10.

The triangular parts, *c*, *c*, *c*, in Fig. 11 (see also *a*, Fig. 10) are pallets, which are pulled down when the corresponding key is played on, and admit the wind to the pipes above. In Fig. 11, *b* is the hinge on which the pallet works; *h* is the wire by which the pallet is pulled down by a connection from the key at *i*; *r*, *r*, are two beadings which hold a brass plate with holes which just fit the pallet wires, as if these holes were made through wood, which damp might swell, the wires would be liable to stick; *l* is the front board, which can be easily unscrewed to give access to the pallets if necessary. The wire spring under the pallet closes it when the key is released. The other letters in the diagram are not necessary to be understood by the reader, who will easily, by a careful study of the picture, comprehend the work which goes on inside the wind-chest.

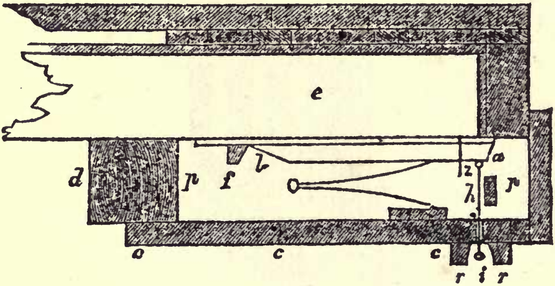
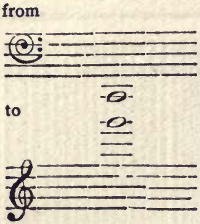


Fig. 11.

Fig. 10 shows three pallets only; but assuming the compass of each manual to be four-and-a-half octaves, i.e.,



there will be fifty-four keys on each manual, and therefore fifty-four pallets inside each wind-chest —whether the wind-chest of the "great," "choir," or "swell" organ, each manual controlling a separate "organ," as it is called.

Now we will try to explain what goes on when a single key on one of the manuals is put down by the player's finger—say, a great organ key. The pulling down of the pallet by the key admits the wind into the "groove" in the sound-board, a board which quite covers the wind-chest, and has long holes or "grooves" cut in it, as in the black marks in Fig. 12.

If the reader will take the trouble to count these grooves, he will find there are fifty-four, that is, one for each of the fifty-four keys on the manual.

The sliders, which are moved by putting out or pushing in the stop-handles, work in the direction from A to B and back. Now suppose that, in the

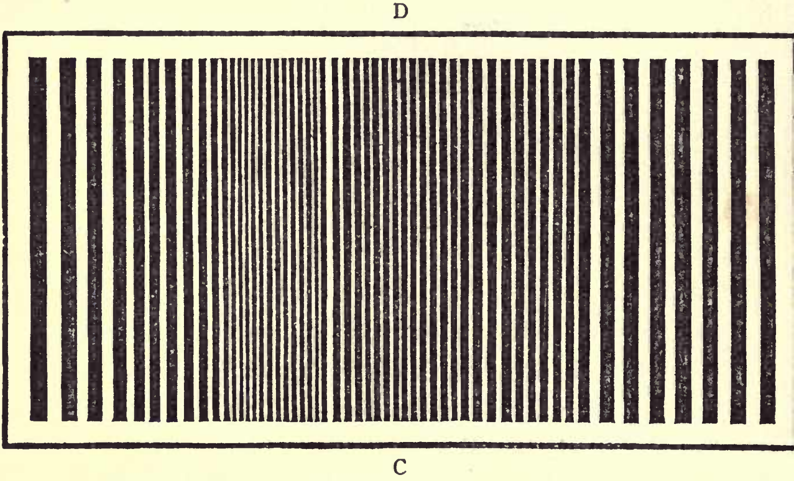


Fig. 12. Sound-board, with Fifty-four Grooves.

above figure of the sound-board, the one on the extreme left is the lowest C on the manual, and the one on the extreme right is the lowest C sharp. *Over* these two grooves are the C and C sharp pipes of, say, twelve stops of different quality, ranged from front to back in the direction from the letters C to D marked on the figure. *Under* these grooves, running from A to B, are the sliders of these twelve stops, arranged side by side, in the direction C to D. The sliders all act alike, and it will suffice to explain the action of one of them. Which of the C pipes over the left-hand groove shall speak, de-

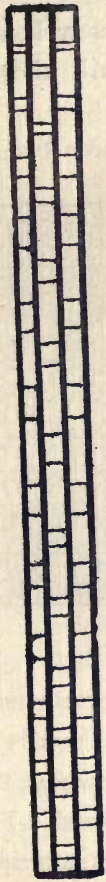


FIG. 13. SLIDER IN.

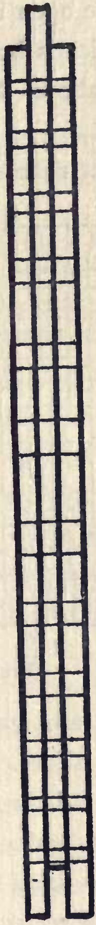


FIG. 14. SLIDER DRAWN OUT.

pends, of course, on which stop-handle is drawn. Say it is the open diapason stop.

Each slider is bored with as many holes as there are pipes above it. Fig. 14 will show what is meant.

The slider runs smoothly between two boards in

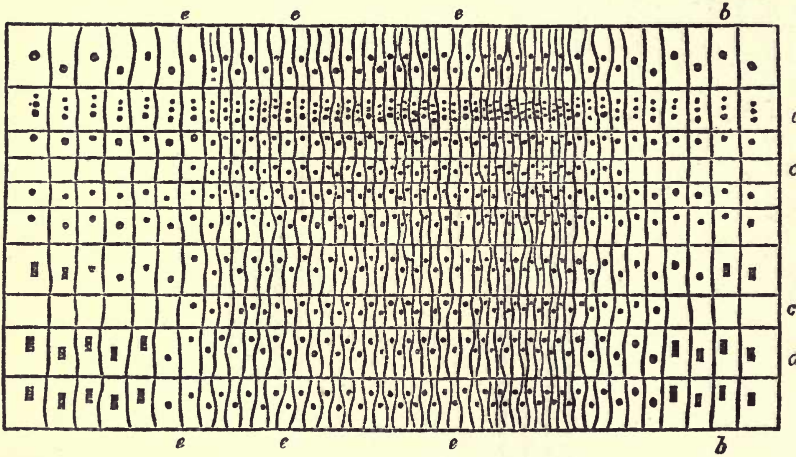


FIG. 15. THE TABLE.

which holes are made exactly corresponding with those in the slider. One of these boards is on the top of the wind-chest, immediately under the slider; the other is under the sound-board. These two boards are so fixed that their holes correspond with the feet of the pipes just over them. When the slider is *in*, the holes in it do not correspond with those in the boards above and below it, and the wind is shut off from the pipes. The above diagrams show the edges of the two boards and the slider, the position of the holes being shown by the vertical lines (Fig. 13). And Fig. 14 shows the slider drawn out by the stop-handle, and its holes brought to fit those of the two boards, so that the wind can go into any pipe of which the stop is drawn, when a pallet is pulled down (Fig. 16).

The grooves are quite closed in by a roof called the table, through which the wind gets to the pipes.

We can now see how the pipes of each stop are placed over the table, the grooves and the sliders. In this case ten stops are provided for. Look along the rows upwards, from *e* to *e*. These show in each case ten holes, for ten pipes of varying quality. The left hand row has the C pipes, i.e., the lowest C on the manual, and the right hand row has the C sharp pipes. Now look along the row *lengthwise* from *a* to *a*. The slider runs in this direction, and when the stop is drawn, admits wind to the whole of the fifty-four pipes of that one stop. In other words, the pipes of the various stops are placed from the front to the back (bottom to top in the figure of the table), while the sliders work from right to left. It will be noticed that the two rows, *c*, *c* (from left to right) are short of a number of holes at each end. These are "short" stops, such as, say, the clarinet and oboe, which only extend to a certain distance towards the bottom and top of the keyboard. The row *d* to *d* has three holes for each note, this being a three-rank mixture, in which three pipes speak for each key put down.

It is perhaps hardly necessary to say that the holes in the table, whether round or square, are larger at the extreme left and right, where are placed the larger pipes, which require most wind.

## CHAPTER II.—HOW THE GROOVES ARE ARRANGED.

IN our illustration of the grooves in the sound-board (see Fig. 12) it will be seen that these grooves are of varying width, the larger ones being for the very large pipes of the collective stops, and that these larger grooves are at the extreme right and left of the sound-board. In this case the groove to the extreme left is for the C pipes of the lowest manual key, and the one on the extreme right for the C sharp, and so on. But there are different ways of arranging these grooves, some of which we will now consider.

The first plan is that of which a very brief outline has just been given. In this distribution the larger pipes are at the ends, and of course the smaller ones in the middle, as will be seen from the following diagram, in which only a few pipes are shown out of the fifty-four sets for which the sound-board provides:

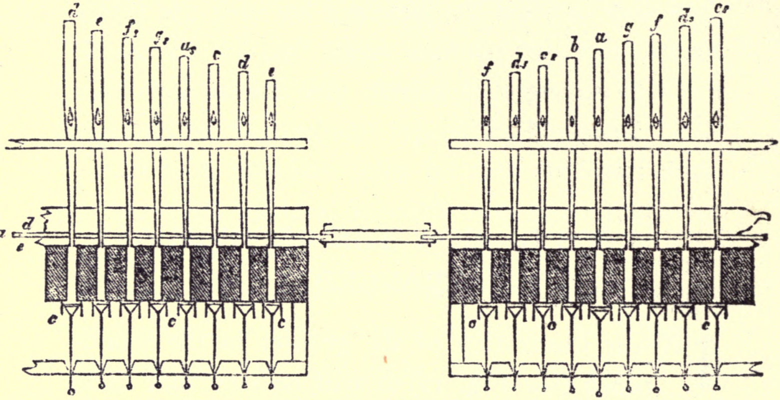


FIG. 16.

This figure explains itself. The half to the left is called the C, and the other half the C sharp side. The break between is the passage board, a passage being left for the tuner's convenience.

A second plan is shown in the next figure, where

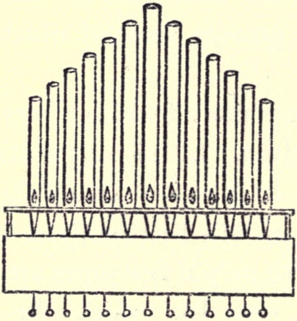


FIG. 17.

the former process is reversed, the larger pipes being placed in the centre, and the size tapering off towards the end on both sides. Here, again, only enough pipes are shown to illustrate the arrangement.

A third method of arrangement is seen in the following figure:

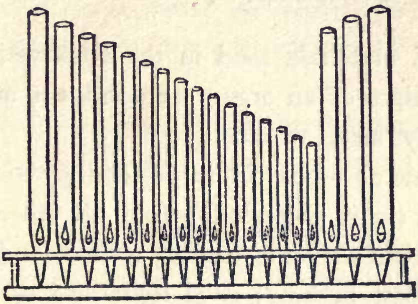


Fig. 18.

in this plan only a few of the larger pipes are placed at the right hand side of the sound-board; the rest, beginning at the left hand, being arranged chromatically (except, of course, in the case of those large pipes at the right hand) from the lowest to the highest note on the manual.

A fourth plan, which needs no figure to illustrate it, places the whole of the pipes in chromatic order from the lowest at the left to the highest on the right. This plan has been adopted by some very eminent builders.

## CHAPTER III.—THE PIPES.

THE materials used in the construction of the pipes of an organ are wood, tin, metal, lead, antimony metal or zinc.

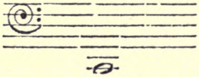
For metal pipes tin is decidedly the best, and English tin is preferred before all others. Tin is harder than the other metals named, and therefore stands best in tune; it is light and durable, and keeps its colour well. It is, however, costly, and is not used pure on that account. Next to pure tin, the best thing is a mixture of tin and lead, known as "spotted metal," because when the two are mixed in the proportion of one-third tin to two-thirds lead, the surface is mottled or spotted all over. None of the other materials mentioned above are found to be of much practical use, except zinc, which is cheap as compared with spotted metal, and cheaper still as compared with pure tin. It has the further advantage of being not greatly affected by those changes of temperature to which most organs, especially those in churches, are liable. The tone of a zinc pipe is somewhat lighter than one of the same size made of tin or spotted metal. Lead is not of much use, as it will not continue to bear its own weight, and in time crumbles and drops to pieces; while antimony metal is too brittle to be of much permanent service. Metal pipes may therefore be taken, as a rule, to be made of spotted metal or zinc.

For the wood pipes, fir and pine are chiefly used, though on the Continent maple, pear and box are employed.

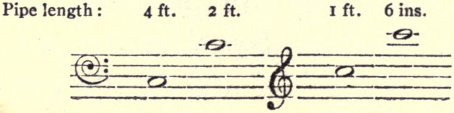
So far as concerns the tone-producing qualities of pipes, they are divided into two great classes: (1) flue pipes, usually called "the flute-work," and (2) reed pipes, known as the "tongue-work," because of the reed or tongue which is the main sound-producing factor in this class of pipes. These two classes each contain many varieties, but the flute-work and the reed-work are so essentially different and distinct that they must be separately considered.

## (A).—FLUTE-WORK, OR FLUE PIPES.

Various names other than "flue pipes" are often applied to this class. Sometimes they are called "lip pipes," or "labials," and "mouth pipes," because of the parts called the "lip" and "mouth," which will be presently described. Reed pipes have no lip or mouth in the sense in which flue pipes have them; hence "lip pipe" or "mouth pipe" always refers to a flue pipe. The round pipes are in this country made of metal, and the square or rectangular ones of wood. Near the bottom of each pipe will be seen an oblong opening, which is the "mouth" above referred to. The part below the mouth—conical in the metal pipes and square in the wood ones—is called the "foot," and the lower end of the foot stands in the holes in the sound-board before referred to. The part above the mouth is the "body" of the pipe, and the length of this body determines the pitch of the note given. Thus a pipe "open" at the upper end (we shall see presently that some are "stopped"), and with a body 8 feet in length, gives this C:



The shorter is the pipe, the higher is the pitch of the note which it gives:



The lengths of the pipes in the lowest octaves thus range down from 8 feet, the length of the lowest C pipe, to 4 feet, the length of the next C pipe. The length of the G pipe between the two is $\frac{2}{3}$ of 8 feet, i.e., $5\frac{2}{3}$ feet; the G pipe above that is half that length; and so on.

The upper and lower edges of the oblong mouth are called the "lips," and in the wood pipes these are bevelled off so as to cut the wind. The projecting pieces on either side of the mouth are called the "ears" of the pipe. Inside the pipe is a horizontal piece of wood (or metal), called the "language," or "languid"; this languid comes so near to the lower lip as to leave only a narrow slit, called the "wind-way," through which the wind, coming from the wind-chest through the "foot," is cut into two streams by the upper lip, one stream going into the outer air, the other rushing into the pipe, causing the air within it to vibrate at a pace which is determined, not by the force of the wind-stream, but by the length of the body of the pipe.

In shape metal pipes are sometimes cylindrical; sometimes conical, and these again are both narrower at top than bottom, and vice versa. These varieties of shape all result in varieties of quality of tone, for reasons which cannot here be explained, and into which it is not the purpose of this work to enter. *Why* various qualities of tone are produced by various shapes of pipes need not trouble us, and the absence of that knowledge will not hinder us from knowing what the inside of an organ is like.

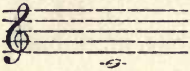
As we have said, the length of the flue pipe is the only factor in fixing its pitch, and without going deeply into questions of quality, it should be explained that the *scale*, or diameter, of the pipe materially affects the tone of it. A pipe of *wide* scale is powerful, vigorous, full in tone; a narrow scale pipe is sharp and clear. The shape of the mouth also influences the quality; a high and wide mouth produces a round and full tone; a narrow mouth, a sharper tone; if the mouth is low as well as narrow, the tone is more delicate; and if it is *very* wide and high, the tone is more hollow.

Wood pipes are made oblong, but nearly square in shape, as well as actually square. The square pipe gives a full tone; if narrow and deep, the tone will be soft and sweet; it broad and shallow, that tone will be more hollow.

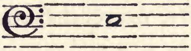
In a wood pipe, the piece which answers the same purpose as the languid in a metal pipe is called the block; the foot is a narrow tube fixed in the bottom of the pipe.

Metal as well as wood pipes of the flue class are sometimes *stopped* by the insertion of a stopper at the upper end. The *quality* of the tone is different when a tubed stopping is used, the *pitch* remaining the same as though the pipe were completely stopped.

The effect of stopping a pipe is to make it produce a tone an octave lower than it would if open. A 2 feet open pipe produces:



a 2 feet stopped pipe produces:



The pipe producing the lowest C of a manual stopped diapason or other stopped manual series, is therefore only 4 feet long, the lowest C of the open diapason or other open series being 8 feet in length. The reason for this change of pitch by the insertion of the stopper is that while in the open pipe, the air vibrates once in the whole length of the pipe, in the stopped pipe the air is turned back by the stopper and returns to the mouth, thus doubling the length of the vibration, and as a consequence deepening the pitch by an octave. In an open pipe the form of vibration is:

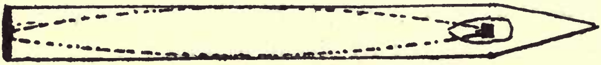


FIG. 19. VIBRATIONS IN OPEN PIPE.

and in a stopped pipe as in the next figure.

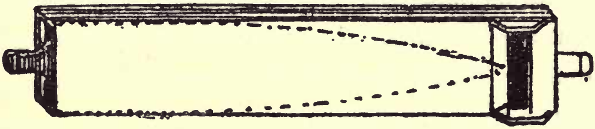
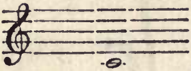


FIG. 20. VIBRATIONS IN STOPPED PIPE.

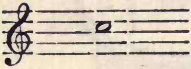
Pipes having a tube, or chimney in the stopper are called half-stopped. The French call them *flûte à chéminée*, a flute stop with a chimney; the Germans call them *Rohr-flute*, or reed-flute, not because they are reedy in quality, but because of the resemblance of the tube or chimney to a hollow reed. The effect of inserting a chimney in the stopper is to make the tone very liquid and smooth.

Speaking broadly, the tone of an open pipe is strong, clear and full; the tone of a stopped pipe, on the other hand, being soft and mellow, and often rather dull and spiritless in quality.

Varieties of quality in flue-stops are also obtained by boring a hole in the pipe. In the keraulophon, invented by Gray and Davison, the pipe has a small hole near the top, resulting in a beautifully soft and somewhat reedy quality. In the Hohlflute (hollow flute) there are two holes opposite to each other, while the Flute Harmonique has a hole half-way up, which raises the tone by an octave; i.e., a pipe of 2 feet length, which, without the hole, would give:



when bored in the middle of its length gives:



A genuine Harmonic Flute is usually put on a somewhat heavier wind than the diapason and other 8 feet work.

## (B).—REED PIPES.

The bodies or tubes, as they are called, of reed pipes are cylindrical; inverted cones; ditto, with bell-shaped openings at the top, and inverted pyramidical shapes of wood.

The tone of reed pipes is produced by the rush of the wind upon a strip of metal, which causes that strip to vibrate. This strip is secured to a hollow tube of brass called the "reed," and these reeds are so made that the strip or "tongue," may produce its tone in three different ways. The reed itself in the first place may be open, as at Fig. 21, or closed, as at Fig. 22; and in the case of the open reed, the tongue may either vibrate freely in the opening without touching the reed itself, when it is called a *free* or open reed; or may vibrate against the edges of the opening, in which case it is called a *striking* reed; or, as in the closed reed, the tongue may vibrate against the body of the reed itself, when it

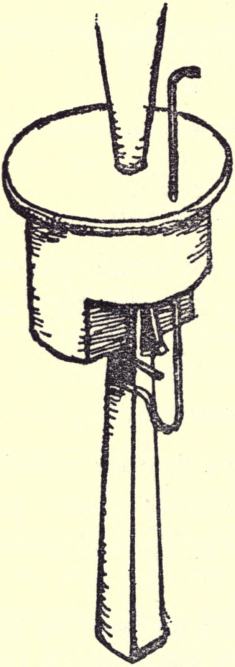


FIG. 21.

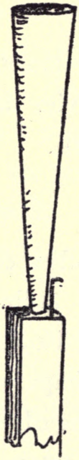


FIG. 22.

is called a *closed* reed. The tongue is tuned by means of a wire which the tuner moves up or down. The part of the pipe to which the reed is fixed is called the block, which is fixed in the "boot," the lower part of which goes into the hole of the sound-board, and corresponds with the "foot" of a flue pipe. These blocks are usually cast in metal, though they are sometimes made of wood. Fig. 21 shows a reed block, with reed, tongue and tuning wire.

The pipes of reed-stops are made of various shapes in order to obtain different qualities of tone.

In a flue stop the pitch is fixed by the length of the pipe, which controls the number of vibrations made per second by the current of air; in the reed stop, the pitch is fixed by the number of vibrations of the tongue, and not by the tube. But, at the same time, the shape of the tube has an important effect in determining the *quality* of the note produced, and that quality is also influenced by the three conditions under which the tongue vibrates. The tone of a closed reed is more subdued than that of an open or free reed; and the open reed, again, produces a less strong and vigorous tone than that of the striking reed. The effect of the shape of the pipe or tube on the tone may be generally indicated thus. Short cylindrical pipes produce a somewhat light tone. The inverted cone produces a more sonorous tone. A thin nasal tone of the bassoon class is produced by a tube of narrow scale; while the addition of a bell-like top to a narrow-scale tube makes the tone of a plaintive or wailing quality, as in the oboe stop. The quality of metal in the tongue, the shape of the opening in the reed, the thickness and amount of bend in the tongue, all have an effect on the quality of the tone. The trumpet and other loud and brilliant reed stops have short, thick, broad tongues; those of the oboe, bassoon and clarinet are longer, narrower and thinner. We append a series of illustrations showing various shapes of flue and reed pipes. As previously explained, the quality of the tone produced by a pipe depends on many things—the material, the shape, whether stopped or open, whether a cone or an inverted cone, and so on.

Thus the word "organ," used in any other sense than when applied to the whole of the instrument, has a peculiar meaning of its own. Thus, "swell organ" means the sets of stops or pipes which are shut up in the swell box (see chapter on the "Swell Organ"); and so with "great organ," "choir organ," or "pedal organ." Each division is thus an "organ" in itself, and is always so spoken of. If the reader will consult the chapter on "The Stops," where we have given a specification of a large organ of over fifty stops, he will see how the word "organ" is used for each and every separate class of stops into which the entire instrument is divided.

## CHAPTER IV.—FROM KEY TO PALLET.

THE keyboard of an organ or pianoforte is in these days so familiar to most people that it is not necessary here to describe its outward appearance.

The organist, having drawn his stops, and the wind being "in," puts down a key, which, by intermediate mechanism, pulls down the pallet corresponding to that key. The pallet, it will be remembered, is underneath the feet of the pipes sounding the note represented by the key put down. It is this intermediate mechanism which we will now consider.

But first let us look, in the next two figures, at a side view of a manual key and pedal key respectively:

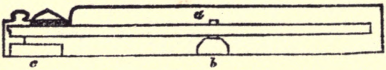


Fig. 23. Side View of Manual Key.

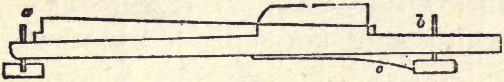


FIG. 24. SIDE VIEW OF PEDAL KEY.

Underneath the manual key is a "pin rail," *b*, and the key has a vertical hole bored in it, not far from the centre of its length from front to back, to work on the pin, *a*, fixed on this rail. Near the front end of the key is another hole which works on a pin in the rail, *c*, the object of this pin being to secure the vertical motion of the key, and to keep the latter steady. To prevent noise when the key goes down, the front rail, as it is called, is covered thickly with green baize or some other soft stuff.

As all the pipes, except those in the front of the organ case, are some distance back away from the keyboard, means must, of course, be employed to reach them. These are collectively called the "key movement," and although there are many variations in detail, the two chief kinds of key movement are: (1) the "fan frame" movement, and (2) the "roller-board" movement.

The fan movement is more simple than the roller-board movement. Assuming that one of the keys is straight right to its back end, the following is one way of reaching the pallet:

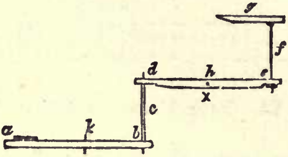


FIG. 25. KEY ACTION.

Here *a* is the key, to which is attached a sticker, *b*, which operates on a backfall, *h*, connected with a tracker, *f*, reaching from the rear end of the backfall to the pallet. On pressing down the key, its rear end rises, pushing up the front end, *d*, of the backfall, *h*, the rear end of which falls, and, by means of the tracker, *f*, attached to it at *e*, pulls down the pallet, *g*. The pallet being thus opened, the wind goes through the pallet-hole into the groove, and through such holes above as have been brought into line by drawing the slider so that its holes correspond with those directly above and below.

It will be readily understood that the sound-board is much longer than the manuals; and, starting from the centre of the keyboard, the grooves will be respectively more and more out of line with the keys as we go to the right or to the left. The rear end of each backfall must be under its own pallet and groove, while its near end must be on its own sticker, the backfalls diverging to right or left as required.

It is this spreading out of the backfalls which shows some resemblance to a fan, and gives the name to the movement.

It will be remembered that the larger pipes, in most organs, are not all at the left hand side of the soundboard, although their keys are at the left end of the keyboard, but are placed alternately at the left and right hand sides. The bass *keys* being thus to the left, and some of the bass *pipes* to the right, of the keyboard, the pallets are reached by a series of "rollers," as they are called, one to each key. The next figure shows a single roller:

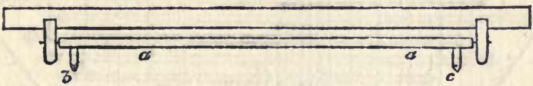


FIG. 26. A ROLLER.

The roller, *a*, *a*, has two arms, *b*, *c;* *b* being over the end of the backfall which goes down when the key is put down, and *c* just under the pallet. The tracker does not now, as in the fan movement, go straight to the pallet, but pulls down the roller arm, *b;* the roller, *a*, *a*, then partially revolves, and brings down the roller arm, *c*, which pulls down another tracker attached to the pallet and opens the latter. Wooden rollers were formerly used, though, where the funds permit, iron rollers are now usually substituted.

The entire series of rollers for one set of pallets is fixed on a frame or board, which is hence called a "roller-board." The order of the keys, in the arrangement of the pipes referred to, never agrees with the order of the pipes, and thus every key must have its own roller. Fig. 27 will serve to illustrate the roller-board principle. Here the lines close together in the centre of the figure represent the trackers attached below to the key backfalls; the lines wider

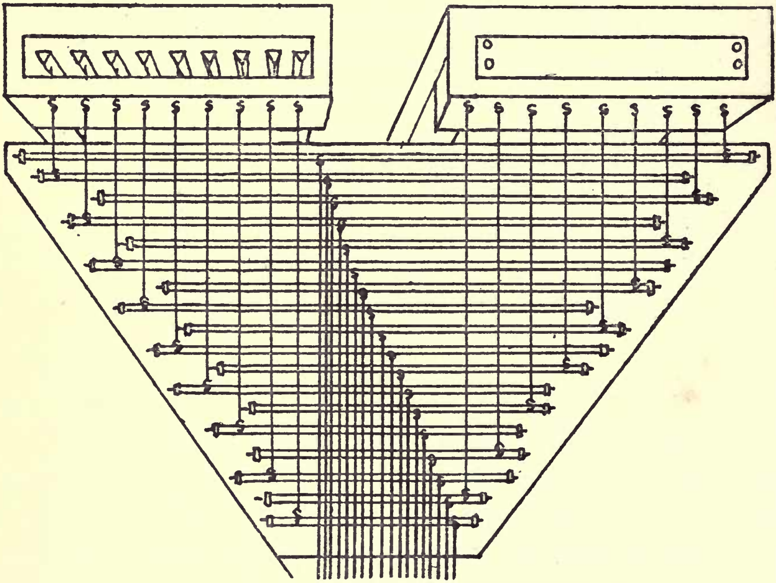


Fig. 27. A Roller Board.

apart to right and left are the trackers fixed at the lower end to the horizontal rollers, and at the upper end to the pallet wires. The putting down of a key pulls down one of the trackers in the centre of the figure; this tracker partly revolves the roller and pulls down the tracker reaching to the pallet wire, letting wind into as many pipes over the pallets as there are stops and sliders drawn. Each roller is thus operated by the tracker from one key, and in its turn operates the tracker leading to one pallet.

# CHAPTER V.—THE STOPS.

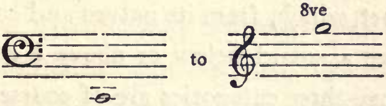
"STOPS," for our present purpose, may be taken to be the direct means of admitting wind to the particular set of pipes on which the organist wishes to play. The player sees, both at his right hand and his left hand, a number of round pieces of ivory with names on them. These ivories are glued to one end of a piece of wood which is in sight, the rest being inside the organ case. These pieces of wood are called "stops." When the stops are "in," no wind can get to the pipes which they control; when they are "out," the wind can reach any of that set of pipes of which the key is put down. The pulling out of a stop some three or four inches moves the slider so that the holes in the latter coincide with the holes below it from the wind-chest, and the grooves above it in the soundboard. Suppose the player pulls out the "open diapason" stop. The slider admitting the wind to the open diapason pipes has thus been so moved that the wind can go through the holes in it to as many pipes as the player puts down keys. The action of the slider, and its place between the wind-chest and the soundboard, have already been explained.

The stops of an organ may be variously classified; first, as to their *compass*, in which respect the only varieties we need to notice here are:

1. Whole stops.
2. Half stops.
3. Short stops.

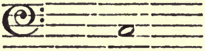
The name "stop" is commonly applied to the set of pipes as well as to the stop-handle which controls them. In this sense we speak of the "open diapason stop," meaning the open diapason *pipes.*

1. A "whole stop" is one the compass of which runs right through the whole of the manual or pedal. Thus the open diapason is a whole stop, because, in an organ the manual compass of which is four and a half octaves, it extends from:



In other words, it is a "whole stop," there being an open diapason pipe for every semitone from the lowest note of the manual to the highest. One stop-handle controls them all.

2. A "half stop" is one the pipes of which only go down as far as 4 feet C:



the 8 feet octave being added by drawing a second stop-handle. Thus, in many small organs, the dulciana stop-handle only controls pipes from 4 feet C to the highest note of the manual, the pipes of the 8 feet octave being controlled by the "stopped diapason" stop, which is so "voiced" as to form a suitable bass to the dulciana. Thus, to get the whole range of the manual to speak when the dulciana stop is drawn, the stopped diapason must be drawn with it. Hence the dulciana is in this case called a "half stop," although its pipes cover much more than half the manual.

3. A "short stop" is the name applied to a set of pipes which are usually imitative, such, for example, as a clarinet, which, from its nature and construction, cannot give a sound below or above a certain note.

The above three categories are of course all sounding stops; but there are also "stops" which do not sound, and which are called "accessories," or "accessory stops." Thus the stops "swell to great," "great to pedal," and so on, serve—the former to couple up the great and swell manuals so that on putting down a key on the great manual the corresponding key on the swell manual goes down with it; and in the second case the pedals and the keys on the great manual are coupled together, so that on putting down a certain pedal the corresponding note on the great manual goes down with it. These couplers, or accessory stops, may all be drawn together, and yet no sound can be got from the organ until some sounding stop is drawn.

Another classification is:

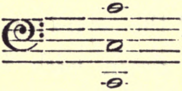
1. Flue stops.
2. Reed stops.

The difference between these two classes has already been explained.

Again, taking the flue stops only, we speak of:

1. Diapason work.
2. Covered work.
3. Flue work.

Diapason work means all the open cylindrical stops which are of open diapason "measure" or deduced from it; thus, in a large organ there will be on the great manual a "principal" and "fifteenth." These stops, when the lowest note of the manual is put down, both give a different note from that of the open diapason, but in each case the length of their pipes is measured from that of the open diapason (see also below, under the heading "Mutation Stops"). The two stops just named, when the 8 feet C key is put down, give the following sounds:



| Name of Stop. | Length of longest pipe. |
|---|---|
| Fifteenth | 2 feet |
| Principal | 4 feet |
| Open Dippason | 8 feet |

Covered work includes all the stopped pipes. The reader will remember that a stopped pipe of 4 feet length gives a note of the same pitch as an open pipe of 8 feet length—the note from a stopped pipe of 2 feet length is of the same pitch as that of an open pipe of 4 feet length, and so on.

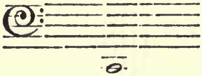
Flute work, or flue work, includes all flue stops which do not come under either of the above categories.

Yet another classification, relating to the *pitch* of the pipes, is as follows:

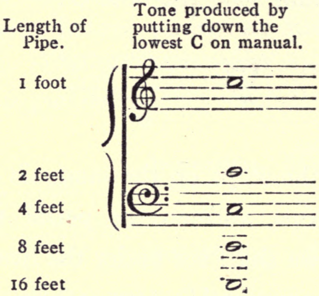
1. Foundation stops.
2. Mutation stops.
3. Compound stops.

A "foundation" stop is one the pipes of which give tones corresponding to the key pressed down.

The foundation of all organ tone consists of 8 feet stops, or stops which, on pressing down the lowest C on the manual, give the note C:



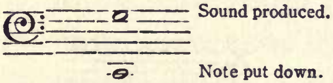
The bulk of the stops on the manuals of any organ are 8 feet stops, and on the pedal 16 feet stops, although, as we shall see under the heads of "mutation" and "compound" stops, others which are not "on the foundation" are necessary for the production of a full and satisfactory volume of sound. These foundation stops are always distinguished by the fact that the sound produced agrees with the key put down. The *length* of the pipe producing the lowest note on manual or pedal may vary; thus it may be 32 feet, 16 feet, 8 feet, 4 feet, 2 feet, or 1 foot; but in each case *the putting down of a C key produces the note C.* A foundation stop may be reed or flue; it may belong to the "diapason" work, the "covered" work, or the "flute" work, as classified above; or it may be "open" or "stopped"; but so long as it is of the standard length, it is a foundation stop. The putting down of the lowest C on the manual may give any of the following notes, according to the length of the pipe; but the C key always produces the C sound:



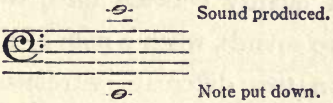
The note produced is in every case C, and thus all these stops are foundation stops. The above notes can all be produced by manual stops, but the 32 feet is only found, except in very rare cases, on the the pedals. The note produced by a 32 feet C stop is not given above, as too many leger lines would be required; but it is, of course, an octave below that of the 16 feet pipe.

On the manual the 8 feet stops, and on the pedal the 16 feet stops, are called "*chief* foundation stops," or unison stops, because they give what is, and always must be, the ground tone on which all the complete volume of tone of the organ is built; the 4 feet on the manual and 8 feet on the pedal are called "octave stops"; and the 16 feet on the manual and 32 feet on the pedal are called "double stops."

A "mutation stop" does not produce a sound corresponding to the key put down. The word "mutation" comes from the Latin *mutare*, to change. Some mutation stops sound G when the C key is put down, and some E. The former are called "fifth sounding," or quint; the latter are called "third sounding," or tierce. Thus, on putting down the lowest C on the manual, a quint mutation stop would give the sound of G above:



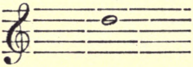
A tierce mutation stop, on putting down the lowest C on the manual, gives the sound of E in the next octave above:



A "compound," or "mixture" stop, is one which has more than one pipe for each key pressed down. Every other stop has but one pipe for each key; the compound or mixture stop has any number of pipes from two to five for each key. The object of these stops is to add brightness to the quality of the other stops, and the reasons for adding compound or mixture stops to the other stops of the organ must now be briefly explained.

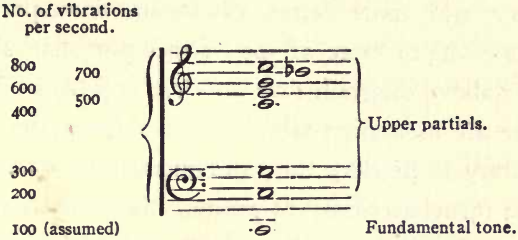
The "harmonic chord" has already been referred to, in connection with the wind pressure question, and we will now see what part the upper notes of that chord take in affecting the *quality* of any sound produced.

By the quality of a sound is meant the difference, say, between the tone of a violin and of a flute when both play, say, the note:



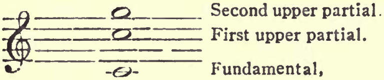
The difference is at once apparent to any ordinary ear, whether it be a "musical ear" or not. That difference of quality between these two sounds, or any other two sounds, when a note of the same pitch is played on two different instruments, as violin and flute, clarinet and oboe, is caused by the presence or absence of certain of the upper notes, or "upper partials," as they are called, of the "harmonic chord" in the tone of the respective instruments.

Now let us look again at this "harmonic" chord.

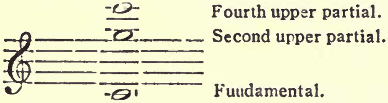


Very few musical sounds are produced by the mere vibrations necessary for the fundamental tone, and those sounds are very hollow, dull and (so to speak) lacking in attractiveness to the ear. On the other hand, no musical sound contains *all* the upper partials as well as the fundamental tone. The differences in the qualities of tone of different instruments, playing a note of the same pitch, are caused by the presence or absence of some of these "upper partial" tones.

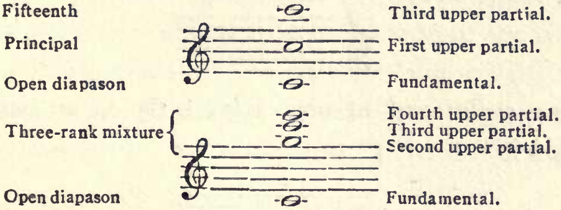
The body of air contained in a tube, whether organ pipe, flute or clarinet, etc., and caused to vibrate by blowing into the tube, or the body of air caused to vibrate by drawing a bow across a violin string, vibrates in other forms beside those which produce the fundamental tone. That is to say, the vibrations of such body of air are not only those of the fundamental tone, but the vibrations producing the latter are broken up into subsidiary and more rapid vibrations, corresponding to some one or more of the "upper partials" shown in the above diagram *(see note on page 14).* Thus, if the air in a pipe vibrates not only in the form necessary to produce the fundamental note, but also in the forms necessary to produce the octave and octave and fifth above it (first and second upper partials) thus:



the *quality* of the C produced will be different from that produced if to the forms of vibration necessary to produce the octave and a fifth and two octaves and a third (second and upper partials) are added the vibrations of the fundamental note, thus:

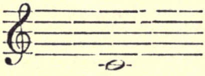


Thus, if from any cause whatever, such as the material of which the pipe is made, etc., the forms of vibration of the column of air within the pipe include not only the fundamental but certain other forms, as just pointed out, the *quality* of the tone will be altered. It is for this reason that organ-builders add certain compound or mixture stops to an organ of only moderate size, and still more of them to an organ of very large size, viz., to add brilliance to the various *qualities* of tone which would be produced by the foundation stops alone. If the reader who has the opportunity will play over an ordinary hymn-tune or chant with only the 8 feet diapason stop drawn, and then draw, say, the principal and fifteenth, or the three-rank mixture stop, he will at once hear how much more "brilliant" is the quality of tone in either of the latter cases. The open diapason alone will be solemn and heavy, or perhaps, clear and round (according to the material and "scale" of the pipes), but on adding the mixture, or the principal (4 feet) and fifteenth, the difference in brightness and brilliance is at once apparent. The following diagrams will show which "upper partials" are added to the fundamental tone according to the stops drawn in the respective cases:

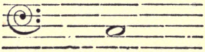


The difference in the quality of tone produced by adding to the open diapason, first the principal, then the principal and fifteenth, and then, pushing in the two latter, and drawing the mixture, will be an ample exposition of the different qualities of tone produced in these cases. The reader will now understand why compound or mixture stops, or both, are found in nearly every organ.

So far as amount or "loudness" of tone is concerned, the fundamental is, and always must be, considerably predominant, the pipes producing the added "upper partials" being made subordinate as to *quantity* of tone. Although the ear alone, unaided by artificial means, cannot detect these upper partials as sounding tones, yet some one or more of them are always there. The reader can easily satisfy himself on this point by the following simple experiment. Sit down at the piano, and lightly put down the key representing "tenor C," without letting the hammer hit the wire:

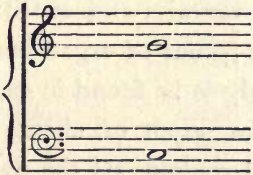


Then strike and at once release the C an octave below:



The sound of the lower C of the two will cease on releasing its key, but the "tenor C" will be clearly heard—a soft but unmistakable "upper partial" of the lower C.

The wire of the latter vibrated not only in its full length, but in two sections of a half each as well. These sections are each of the pitch of the "tenor C," and the vibrations of the former will cause the wire of the latter to vibrate, thus proving that "tenor C" is one of the "upper partials" of the C below. Try a similar experiment with these two keys, holding down the G quietly, and striking and releasing the C key as before:



This will prove that the G, the second upper partial of the C, is also present in the tone of the latter.

If this explanation is somewhat long, it will, it is hoped, suffice to inform the reader of the necessity for "mutation" or "compound" stops in the organ.

## CHAPTER VI.—THE STOPS *(continued)*.

THE reader will now be ready to learn something of the names of the stops, and of what is to be expected when a certain stop is drawn. The size of this book will not permit of a full description of *all* the varieties and qualities of stops due to the inventive genius of organ builders, and some of which are only to be found in exceptionally large instruments. An organ of about fifty stops contains, or should contain, all the useful varieties of stops for general use.

The list of stops in any given organ is called the "specification," and we will first give a specification of an organ with fifty-three sounding stops, arranged on four manuals and pedal:

### GREAT ORGAN—14 STOPS.

| NAME. | MATERIAL. | LENGTH OF LOWEST PIPE. |
|---|---|---|
| 1. Double Open Diapason | metal | 16 feet |
| 2. Bourdon | wood | 16 feet |
| 3. Open Diapason | metal | 8 feet |
| 4. Open Diapason No. 2 | metal | 8 feet |

| NAME. | MATERIAL. | LENGTH OF LOWEST PIPE. |
|---|---|---|
| 5. Gamba | metal | 8 feet |
| 6. Stopped Diapason | wood | 8 feet |
| 7. Principal | metal | 8 feet |
| 8. Harmonic Flute | metal | 8 feet |
| 9. Twelfth | metal | 3 feet |
| 10. Fifteenth | metal | 2 feet |
| 11. Full Mixture | metal | 3 ranks* |
| 12. Sharp Mixture | metal | 4 ranks |
| 13. Posaune | metal | 8 feet |
| 14. Clarion | metal | 4 feet |

### CHOIR ORGAN—9 STOPS.

| | | |
|---|---|---|
| 15. Open Diapason | metal | 8 feet |
| 16. Dulciana | metal | 8 feet |
| 17. Salicional | metal | 8 feet |
| 18. Hohlflöte | wood | 8 feet |
| 19. Principal | metal | 4 feet |
| 20. Waldflöte | wood | 4 feet |
| 21. Flautina | metal | 2 feet |
| 22. Dulciana Mixture | metal | 2 ranks |
| 23. Clarionet | metal | 8 feet |

### SOLO ORGAN—4 STOPS.

| | | |
|---|---|---|
| 24. Tuba Mirabilis | metal | 8 feet |
| 25. Vox Angelica | metal | 2 ranks |
| 26. Vox Humana | metal | 8 feet |
| 27. Harmonic Flute | metal | 4 feet |

### SWELL ORGAN—13 STOPS.

| | | |
|---|---|---|
| 28. Bourdon | wood | 16 feet |
| 29. Open Diapason | metal | 8 feet |
| 30. Salicional | metal | 8 feet |
| 31. Stopped Diapason | wood | 8 feet |

---

* A mixture of "3 ranks" means that three pipes sound for each key put down, i.e , three ranks of pipes.

| NAME. | MATERIAL | LENGTH OF LOWEST PIPE. |
|---|---|---|
| 32. Principal | metal | 4 feet |
| 33. Lieblich Flute | metal | 4 feet |
| 34. Twelfth | metal | 3 feet |
| 35. Fifteenth | metal | 2 feet |
| 36. Mixture | metal | 3 ranks |
| 37. Double Trumpet | metal | 16 feet |
| 38. Cornopean | metal | 8 feet |
| 39. Oboe | metal | 8 feet |
| 40. Clarion | metal | 8 feet |

### PEDAL ORGAN—13 STOPS.

| | | |
|---|---|---|
| 41. Double Open Diapason | metal | 32 feet |
| 42. Double Open Diapason | wood | 32 feet |
| 43. Open Diapason | metal | 16 feet |
| 44. Open Diapason | wood | 16 feet |
| 45. Violone | wood | 16 feet |
| 46. Bourdon | wood | 16 feet |
| 47. Principal | metal | 8 feet |
| 48. Violoncello | wood | 8 feet |
| 49. Twelfth | metal | 6 feet |
| 50. Fifteenth | metal | 4 feet |
| 51. Mixture | metal | 3 ranks |
| 52. Trombone | wood | 16 feet |
| 53. Clarion | metal | 8 feet |

### COUPLERS.

1. Swell to Great
2. Swell to Octave
3. Swell to Sub-octave
4. Solo to Great
5. Swell to Choir
6. Great to Pedal
7. Choir to Pedal
8. Swell to Pedal

### COMPOSITION PEDALS.

4 to Great and Pedal
3 to Swell Organ
3 to Pedal Organ

Let us now consider these stops one by one, and give some further necessary particulars not found in the specification.

## GREAT ORGAN.

1. Double Open Diapason.—Length of lowest pipe on manual 16 feet, on pedal, 32 feet. Made of tin, metal or zinc (the reader will see elsewhere what is meant by "metal" as distinguished from "tin" and "zinc").

2. Bourdon.—A covered stop of 16 feet *tone* on the manual. Thus, though the longest pipe on the manual is only 8 feet, the stop, being a "covered" or stopped pipes, gives a 16 feet tone.

3. Open Diapason.—A whole stop of 8 feet length; it is called "open" to distinguish it from the "stopped" diapason, the longest pipe of which is 4 feet. Longest pipe, 8 feet.

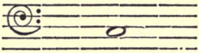
4. Open Diapason, No. 2.—In a large organ, standing, say, on a cathedral choir screen, one open diapason would face the east side and the other the west.

5. Gamba.—A "short" stop, usually ending downwards at tenor C. "Reedy" tone, sharp and pungent. It is of 8 feet pitch, i.e., if it were carried down as a "whole" stop, its longest pipe would be

8 feet. It is sometimes of conical shape, and surmounted by a "bell."

6. STOPPED DIAPASON.—Made of wood; longest pipe, 4 feet, but sounding an 8 feet *tone.*

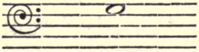
7. PRINCIPAL.—Usually made of metal; pitch, an octave higher than the open diapason, so that when the lowest note on the manual is put down, the sound heard is:



This is one of those stops the purpose of which is to brighten the tone of the organ.

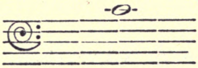
8. HARMONIC FLUTE.—Same pitch as the open diapason, but the longest pipe is 16 feet. The bodies of the pipes are bored with a hole half way between the foot and the top, which causes the 16 feet pipe to give an 8 feet tone. Wants a heavy wind. Tone, full, fluty and powerful; imparts breadth and thickness.

9. TWELFTH.—A metal stop, sounding an octave and a fifth above the open diapason. The lowest manual C thus gives the note:



This is a "mutation" stop. Longest pipe, $2\frac{2}{3}$ feet.

10. FIFTEENTH.—Pitch, two octaves above the open diapason, the lowest C on the manual giving:



Longest pipe, 2 feet.

11. FULL MIXTURE, 3 RANKS.—Three pipes sound for each key put down, usually the fifteenth, nineteenth and twenty-second of the fundamental note.

12. SHARP MIXTURE, 4 RANKS.—Four pipes sound for each key put down, usually the nineteenth, twenty-second, twenty-sixth and twenty-ninth of the fundamental tone.

13. POSAUNE (TROMBONE).—A full-toned and powerful reed stop of 8 feet pitch.

14. CLARION.—A 4 feet reed stop; the tone is sharp and clear.

## CHOIR ORGAN.

15. OPEN DIAPASON *(see above)*.—The open diapason on the Choir Organ is usually of less scale than, and therefore not so loud as, that on the Great Organ.

16. DULCIANA.—A delicate, sweet-toned stop, made of metal pipes of small scale. Usually stops downwards at tenor C.

17. SALICIONAL.—A reedy-toned stop of small scale. Penetrating tone, but of slow speech.

18. HOHLFLÖTE (OR HOLLOW FLUTE).—This stop is sometimes made of metal. The tone is somewhat "hollow," hence its name.

19. PRINCIPAL.—*See on Great Organ*, but here it is of less scale.

20. WALDFLÖTE (WOOD OR FOREST FLUTE).—Formed of open wood pipes of large scale. Full-toned and powerful.

21. FLAUTINA.—Answers the same purpose as the fifteenth on the Great Organ, its pitch being two octaves above the fundamental note.

22. DULCIANA MIXTURE, 2 RANKS.—A mixture of a softer quality than that on the Great Organ. A 2-rank mixture usually sounds the twenty-sixth and twenty-ninth of the fundamental tone.

23. CLARIONET.—An agreeable reed stop of 8 feet tone. A "short" stop, of compass limited to that of the instrument itself. Its tone, when rightly voiced, is of great sweetness and beauty.

## SOLO ORGAN.

24. TUBA MIRABILIS.—This is the most powerful 8 feet manual reed stop. The pressure of wind required is three or four times that of the usual organ wind; and the tone is majestic in the extreme. It is usually put on its own sound-board, and has its own bellows.

25. VOX ANGELICA (OR VOX CÉLESTE).—A stop consisting of a delicate gamba and a dulciana for each note. These are first tuned in unison, and then one of the two pipes slightly sharpened, which causes those beats or wavy sounds characteristic of the undulating sound of this stop. The theory of "beats" is too extended for treatment in this work.

26. VOX HUMANA.—A stop intended to imitate the sound of the human voice; a "whole" stop of 8 feet tone.

27. HARMONIC FLUTE *(see Great Organ)*.—The principle of the stop is here the same, though the scale, and material of which the pipes are made, give a quality of tone suitable for solo purposes.

## SWELL ORGAN.

28. BOURDON.—A wood stop of 16 feet tone.

29. OPEN DIAPASON.—A metal stop of 8 feet length. *(See remarks under "Harmonic Flute" on the Solo Organ)*—a remark which applies to all stops of the same name, pipe length, etc., on different manuals.

30. SALICIONAL.—A metal stop of 8 feet length.

31. STOPPED DIAPASON.—A wood stop. *(See remarks under 27 and 29.)*

32. PRINCIPAL.—Metal, 4 feet.

33. LIEBLICH FLUTE.—Sometimes of wood and sometimes of metal; 4 feet length and tone. "Lieblich" is a German word meaning lovely, charming, delightful.

34. TWELFTH.—*(See the same named stop on the Great Organ, and remarks under 27 and 29)*, which apply also to:

35. FIFTEENTH, and to

36. MIXTURE, 3 RANKS.

37. DOUBLE TRUMPET.—A 16 feet reed stop, usually of metal, though the lowest octave is sometimes of wood. Its tone, on the Swell Organ, is somewhat weaker than that of the trumpet sometimes put on the Great Organ. The "double" trumpet means, as

before explained, that its pitch is an octave below that of the "foundation" 8 feet stops.

38. CORNOPEAN.—A reed stop of 8 feet pitch, usually of metal. It belongs to the trumpet class, but is differently "voiced."

39. OBOE.—An 8 feet metal reed stop, of small scale, in imitation of the orchestral oboe. It is sometimes spelt "hautboy" on stop-handles. This is a "short" stop, with a soft and plaintive tone, like its prototype.

40. CLARION.—*See under "Great Organ," with remarks to 27 and 29.*

## PEDAL ORGAN.

The reader will remember that on the Pedal Organ most stops are of a pitch an octave lower than their namesake on the Great Organ, and their pipes of twice the length. They are, in fact, "bass" stops. The following table shows this:

| | LENGTH ON GREAT ORGAN. | LENGTH ON PEDAL ORGAN. |
|---|---|---|
| Double Open Diapason | 16 feet | 32 feet |
| Open Diapason | 8 feet | 16 feet |
| Principal | 4 feet | 8 feet |
| Twelfth (or Quint) | 3 feet | 6 feet |
| Fifteenth | 2 feet | 4 feet |
| Trombone (or Posaune) | 8 feet | 16 feet |

With this explanation, we need only mention here the following three pedal stops in the above specification:

45. VIOLONE.—A 16 feet wood stop having, as its name implies, a "stringy" quality of tone, its pitch being an octave lower than that of a violin. It is the bass to the gamba, *which see.*

48. VIOLONCELLO.—An 8 feet wood stop, the name of which will indicate its quality without explanation.

53. CLARION.—An 8 feet metal stop with a bright ringing quality of tone.

The fifty-three speaking stops in this specification do not, as is obvious, include every single quality of stop to be found in a very large organ like that, say, at the Albert Hall, London, though they do include most of the classes of quality. We will now mention a few stops not in our specification, which are found in many modern organs containing about the same number of stops.

GAMBA.—A manual metal 8 feet stop of great beauty of tone, usually stopping downwards at tenor C. It is reedy in quality, and its tone is pungent and "cutting."

KERAULOPHON.—Also a manual metal stop of 8 feet, usually stopping at tenor C, and reedy and pleasant in tone—a quality produced by boring a small round hole near the top of the pipe. It was invented by Messrs. Gray and Davison.

GEMSHORN.—A flue stop, made, at the top, one-third of the diameter at the mouth. A 4 feet stop generally, of light and clear tone.

PICCOLO.—A wood stop of 2 feet length, like the fifteenth, but of different quality. Usually ends at tenor C.

FLAGEOLET.—Also of 2 feet length, of smaller and sharper tone than the piccolo.

SESQUIALTERA.—A "compound" stop, of 2, 3, 4 or 5 "ranks"; a 5-rank sesquialtera would, of course, consist of five pipes for each key, pitched respectively a seventeenth, nineteenth, twenty-second, twenty-sixth and twenty-ninth above the "ground," or open diapason pitch. The object of this stop is the same as that of the mixtures, that is, to give brightness to the general tone by adding to it some of the "upper partials" of the fundamental tone. This class of stop, it need hardly be said, is therefore never used alone, but only in combination with plenty of 8 feet stops.

HORN.—An 8 feet manual reed stop, the name of which indicates its quality.

BASSOON.—A nasal-toned reed stop, metal or wood, of 8 feet length on the manual and 16 feet on the pedal. One of the imitative "short" stops.

Other stops with "fancy" names are to be found, but their qualities mostly belong to one or other of the classes already mentioned.

The COUPLERS in our specification explain themselves. The COMPOSITION PEDALS serve to push out certain classes of stops at once, without the necessity of pulling out each one separately by hand. They are of great variety as to their effects. Thus one composition pedal may bring out all the 8 feet stops, with enough "mutation" stops to "brighten them up"; another may add the mixtures; another the reeds; and so on.

Unless the specification of an organ is specially drawn up for the builder (in which case he will, of course, work to it), he uses his own judgment, guided by the money to be spent, as to what composition pedals he will put in any particular organ. These composition pedals, like the couplers, are a very great aid to the organist in quickly obtaining certain variations in the quality and quantity of tone he wishes to produce.

With these explanations, the reader who meets with a church organ of any number of stops up to forty or fifty (and few church organs go beyond fifty), will be able to understand the quality of tone, pitch, construction, etc., of any of these stops, and will also know how to combine certain classes of stops in order to produce different qualities of tone according to requirements. It is perhaps hardly necessary to say that these requirements vary very considerably. In accompanying a choir in a church service, different effects are required from those necessary in giving an organ recital, where, of course, the organ alone speaks. And in playing a church service, the organist will need great judgment, taste and musical knowledge, all of which we assume he possesses. But, even in the work of the service in church, there are "choirs *and* choirs." One choir will need plenty of "backing up"; it cannot be trusted to do its work unless the organist plays and rigidly adheres to the actual four parts taken by the choir. In such a case the organist cannot, and dare not, leave his choir to do its work while he plays what is alone worthy the name of an "accompaniment." But when an organist has with him a choir which can do its part of the work without him altogether, and can go through a whole service without an organ at all, then, and then only, can he truly "accompany" the service. In this case he will want to use different classes of stops from those which are necessary in "keeping his choir together," because his choir can keep itself together, and leave him perfectly free to use his fancy, reverently, of course, and in strict keeping with the sacredness of the words he accompanies and with the whole object of the service. With a choir which must be "held together," the organist's choice of stops will necessarily be limited to those which form a suitable basis for the singing; while with a choir able to sing the whole service, the entire range of stops, and all possible (or useful) varieties of quality, will, on a good organ, be at his disposal to add beauty, dignity and grandeur to the service. It is under these latter circumstances that the church organist finds the vast and varied use of the couplers and composition pedals of the greatest assistance, because by their aid he can instantaneously produce any quality, or desired combinations of quality of tone desired.

This book is not written specially on the subject of accompanying the church or chapel service, and the author ought perhaps to apologise for introducing the subject at all into a work on "The Organ from Within." But perhaps the reader, especially if he is an organist, will pardon the author if the latter, in this place, says a few words in explanation of what is meant by "accompanying" the service

There is much more involved in this than may at first sight appear. As before said, the organist can only "accompany" the service when his choir is independent of him, and he is independent of his choir. Let us consider any ordinary hymn tune, or double chant, and point out a few of the many ways in which an accompaniment may be treated. Say the morning is foggy, and the voices "husky" and tending to flatten—a contingency which may happen with the very best choir in the world. Then the melody should be played on some light 4 feet stop, which will bring the sopranos, and often with them the other parts, back to their "bearings" again. Or the altos or tenors (usually the altos) are weak, and in this case the player will occasionally use some light reedy stop on a separate manual for the alto part only, in order to give it some prominence. The same thing may occur in any other of the four parts, and the organist will know how to judiciously help the weak-kneed parts of his choir. And when a choir can be fully and wholly trusted to lead the congregation, it is a real delight to hear the full four-part harmony played on the swell and pedal organs, and, on another manual, an independent melody played on some light reed or flue stop—a melody which is neither that of the tune nor chant itself, nor any one of its inner parts, but a judicious and musicianly combination of all three. No rules can be laid down for the production of these independent melodies, and the fully-equipped player will need none. But, when executed with taste and judgment, they add a distinct beauty to the body of the music, though they must not be so obtrusively loud as to mislead the congregation at large. These, of course, are only a few ways of varying the accompaniment, and many others will suggest themselves to the player of ability and taste.

It is in playing of this kind that the couplers and composition pedals, which can be operated with hands or feet in a fraction of a second, are of the greatest possible use to the discriminating organist, because they enable him to bring on some stops of a certain quality and shut off others which he does not at the moment want. These couplers and pedals do not of themselves "speak," but they are the intermediate and necessary means of making others speak or be silent.

## CHAPTER VII.—THE STOP ACTION.

THE reader already knows that the rows of pipes do not speak until the stops controlling them are drawn; and the drawing of any particular stop draws out the slider which, when its holes coincide with those above and below it, admits the air to the pipes in accordance with the keys put down by the player. Let us now see how the pulling out of a stop-handle moves the slider.

There are several ways of doing this, and we will look first at the

### WOODEN-TRUNDLE STOP ACTION.

The stop-handles are of varying lengths, according to their distance from the slider which they have to move; and some, of course, operate to the right hand and others to the left hand; and in most cases the slider is at a higher level than the stop-handle, so that the mechanism requires joints and levers working in different ways.

In the next figure *a* is the stop-handle, and *f* the knob at its outward end containing the name of the stop. It is jointed to the little bar, *g*, which is fastened to the trundle, *b*, *b*, the bar, *h*, being fixed in the trundle, and moving to the left when the stop is pulled out. This bar, *h*, is jointed to *o*, *o*, which is in its turn jointed to the bottom end of the lever, *d*, which is jointed to the slider, *p*.

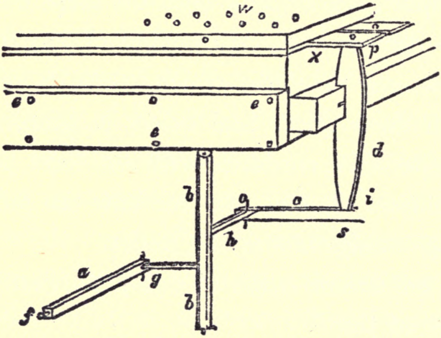


FIG. 28. WOODEN TRUNDLE STOP ACTION.

The process is therefore as follows: the drawing out of the stop-handle turns the trundle on its axis, which draws the bar, *h*, to the left hand, whereby the bar, *o*, *o*, pulls the lower end of the lever, *d*, also to the left, and the upper end of the lever moves to the right, pulling out the slider, *p*, and causing the holes in the latter to coincide with those in the boards above and below. The

### IRON-TRUNDLE STOP ACTION

is more simple, and the following figure will make its action clear, the trundles and arms being here made of wrought iron.

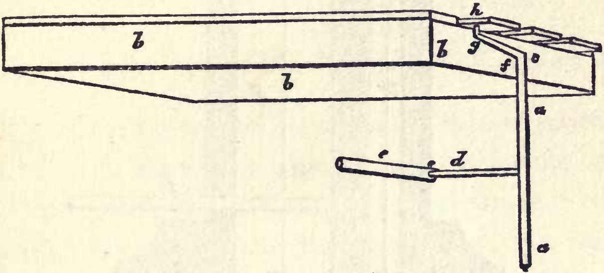


FIG. 29. IRON TRUNDLE STOP ACTION.

There is also a

### PNEUMATIC STOP ACTION,

the working of which will be seen from the next figure. Here the outer boards, *a, a,* are fixed, and the middle one, *b,* is movable; *c* and *d* are two sets of ribs; *e, e, e,* is the wind-chest; *o, o,* is the valve. The stop action is connected with *k,* and the slider with *l.* The wind goes from the wind-chest by way of *f, f,* into *g, g,* thus filling those bellows, moving the board, *b,* close to *a* and moving the slider by the rod, *l.* When the stop is drawn and *k* pulled to the right, the condition of the two parts of the bellows is reversed, the bellows, *g, g,* are emptied and the bellows, *t*, *t*, filled, moving the slider in the reverse direction.

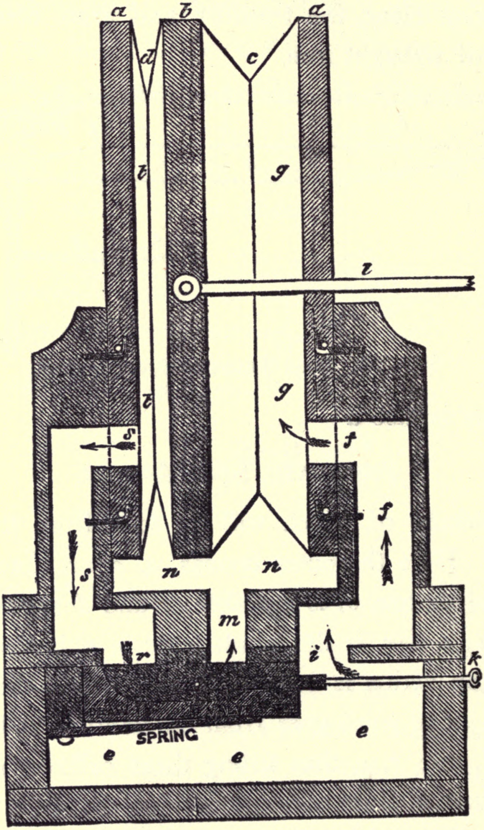


Fig. 30. Pneumatic Stop Action.

## CHAPTER VIII.—THE PNEUMATIC ACTION.

WITH the tracker action the amount of pressure of the fingers required to put down the keys is very great, and the fatigue to the player is also great. The reason for this is obvious. To begin with, each pallet has a spring under it to close it, and the resistance of this spring has to be overcome. In addition to this there is the pressure of the wind on the pallet, and this, especially when the wind is heavily weighted, as, for instance, for a powerful reed stop, is also great. It is thus a very tiring business to play the full organ on a large tracker instrument, and early in the last century attempts began to be made to relieve this pressure. Soon after Barker invented the "pneumatic lever" in 1832, he wrote to Dr. Camidge, the organist of York Minster, to tell him of his invention, and to ask his permission to apply it temporarily as an experiment to one of the heaviest keys on the organ; and Dr. Camidge, in his reply, said: "It is most laborious work to go through a grand chorus or last voluntary with the whole power of the instrument. . . . I, with all the energy I rally about me, am sometimes inclined to make a full stop from actual fatigue in a very short time after the commencement of a full piece."

The pneumatic lever most excellently performs the work of relieving the finger-pressure required in tracker organs. Mr. Joseph Booth, an organ builder, of Wakefield, invented in 1827 a method of applying pneumatic relief. In 1835 Mr. David Hamilton, of Edinburgh, went a step further in this direction; and Mr. Barker, an Englishman resident in Paris, carried the matter still further, and led to the pneumatic principle being largely adopted by organ builders in this country.

Many pneumatic inventions, for the purpose of relieving the pressure required from the fingers, have been made since Barker's time, and although these naturally differ in details, the principle involved is the same in all, and that principle will be best understood by an illustration. The upper part of the lever is like a small concussion valve (see *a*, Figs. 31 and 32), the former showing the lever closed and the latter showing it open. Under the levers are two little chambers, *c*, *c*, *d*, *d*, between which is a third, *e*, *e*, *e*. Below is a sort of back-fall *o*, *o*, which operates on two circular pallets, *b*, *b*, so that when one is open the other is closed. At the rising end of the lever is a small lug, *w*, which draws up a tracker, *f*, which sets the key movements in motion. On pressing down a key on any of the manuals, the near end of the backfall, *o*, *o*, is drawn down, the far end rises, and puts the round pallets in the position in Fig. 32. Part of the wind in *c*, *c*, goes down through the pallet hole which is uncovered, goes along the passage, *e*, *e*, *e*, and raises and fills the pneumatic lever, *a*, which pulls up the tracker, *f*, and the impulse

FIG. 31.

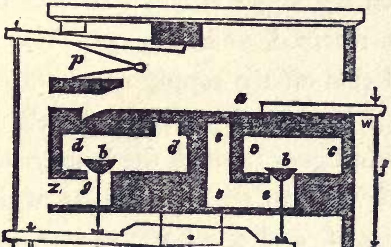
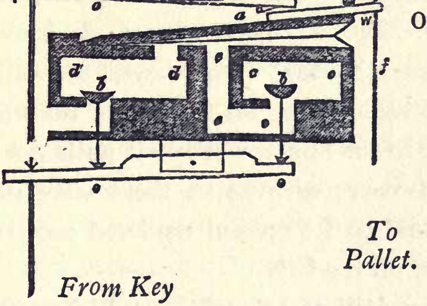


FIG. 32.



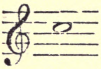
is given to all pallets controlled by the key pressed down. The round pallet in the chamber, *d*, *d*, closes at the same time, and prevents any wind from escaping. When the finger is removed from the key the position is reversed, as in Fig. 31. The pallet goes down and cuts off the supply of air from the wind chamber. The second pallet in the chamber, *d*, *d*, rises, the wind goes through the hole, *g*, and into the outward air through *z*. The contents of the lever are now exhausted, and it returns to rest, as shown in Fig. 31. Thus all the key has to do is to pull down the tracker marked " from keys," the wind pressure thus operated doing all the rest of the work without fatigue to the finger, whether it pulls down one pallet or twenty; whereas on the tracker organ, every additional pallet opened rendered necessary greater pressure on the key.

Messrs. Hill and Son, Messrs. Bishop and Son, Mr. Willis and many other organ builders, have designed improvements in and modifications of the methods employed; but, in all, it is *compressed air* which operates the mechanism which pulls down the pallet, and lightens the pressure on the manual keys.

## CHAPTER IX.—THE COUPLERS.

THE organist often desires to combine the tones of one or more stops on one manual with those of some stop or stops on another. For instance, he is playing, we will say, on some soft eight feet and four feet flue stops on the great organ, and wishes to combine with those stops, let us suppose, a soft reed stop on the swell organ, e.g., the oboe. It is therefore necessary in this case that when he puts down any keys on the great organ manual, they should at the same time bring down the corresponding keys on the swell organ manual. In the same way the player may wish to join a pedal stop with some stop on one of the manuals. This is done by means of what are called "couplers," the word, of course, meaning that one manual is "coupled" to another.

Couplers, broadly speaking, are of two kinds, manual couplers and pedal couplers. The manual couplers, again, are of three kinds;

UNISON COUPLERS, which, when, say, the note  is played on the great organ manual, brings down the same key on the swell organ manual when the "swell to great" coupler is drawn.

OCTAVE COUPLERS, which bring down on the coupled manual a note an octave higher than that played; and

SUB-OCTAVE COUPLERS, which bring down the note an octave below.

Couplers usually unite an upper manual to a lower, as "swell to great," but occasionally they unite a lower to an upper, as "choir to great"; though the former are by far the most numerous. We will therefore confine our description to the kind in general use.

This coupler consists of a set of "stickers," one for each key on the manual. If the reader will look at the next figure, he will see the back of the swell key, *b*, over the back of the great key, *a*. Between these two is the coupling mechanism.

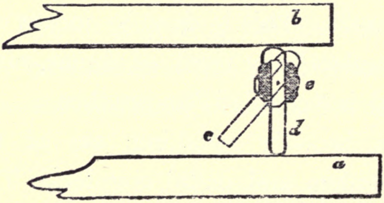


FIG. 33. THE "TUMBLER" COUPLER.

The shaded part shows a section of a rod, *e*, which runs the whole length of the manuals. Through this rod are fixed the stickers, *d*, of which only one is here shown. When the "coupler" stop-handle is *in*, the stickers are in the sloping position shown at *c*, and when the front end of the "great" key goes down and the back end rises, it has no effect on the "swell" key But when the "coupler" stop is drawn out, the rod, *e*, turns on its axis far enough to bring the sticker into the upright position shown at *d*, in which position it just lightly touches both the lower (great) and the upper (swell) key. If now the great key is put down by the player, its back end, on rising, will, by the sticker, push up the back end of the upper (swell) key, and the pipes of whatever stops on the swell organ happen to be drawn, just the same as if the swell key had been put down by the finger.

This is called the "tumbler" coupler, but if the coupler is drawn while the organist is playing on the great organ, it has a slight tendency to jerk the fingers off the keys. To avoid this the "sliding" coupler was invented. In this coupler, as shown in the figure, part of the upper side of the great organ key is cut away, leaving a slope, *a*, which is leather covered and rubbed with black lead to ensure quietness and smoothness of action. The lower side of the swell key is also cut away, but in the reverse direction. When the coupler is not in action, the sticker stands as at *l*, *l*, resting in the "register," *n*, *n*, and the space cut out in the great organ key allows it to rise without affecting the swell key above it. When the coupler stop-handle is drawn out, the "register" is carried back to the position at *o*, *o*, the sticker slipping up the slope at *a*, and rising a little out of the register, so that it stands under the button, *d*, fixed to the swell key, and on the back end of the great key rising, the back end of the swell key is pushed up, the same effect being produced as by the tumbler coupler. The back part of the knob at the top of the sticker is bevelled, and if a great organ key is down when the coupler is drawn, the bevel causes the swell key to rise gradually instead of suddenly as with the tumbler coupler.

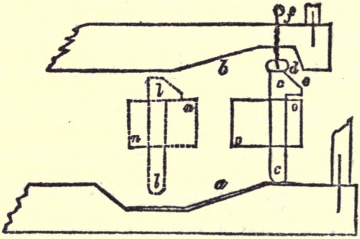


FIG. 34. THE "SLIDING" COUPLER.

Other variations of detail in the couplers have been invented, but the two here illustrated show the general principle.

Octave and sub-octave couplers do not always take the keys down, but usually communicate with separate pallets without touching the keys the pipes of which are to be coupled.

By the aid of the unison, octave and sub-octave couplers, when all three are present, an eight feet stop may be augmented by a sixteen feet or a four feet, or both; or all three may be used together, thus enabling a great variety of effects to be obtained.

The pedal coupler acts in much the same way, but owing to the pedal keys being so much wider apart than the manual keys, a different mechanism has to be used. Rollers have to be used, similar in effect to the "roller-boards" already spoken of in connection with the key-to-pallet action. One arm of the roller

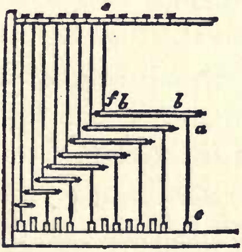


Fig. 35. The Pedal Coupler.

is directly over the pedal key as at *a* in the figure, and the other directly under the key, *c*, to be acted on, as at *f*. Stickers are used, which in one position miss the keys, and in the other position act upon them, as with the manual couplers. On a three-manual organ there may be three pedal couplers, one to each manual; "great to pedal," "choir to pedal" and "swell to pedal," and in this case there will be three sets of stickers to each pedal, i.e., one to each manual to be coupled with the pedal.

## CHAPTER X.—THE SWELL ORGAN.

THE reader will find in another chapter an explanation as to why each of the various divisions of the instrument is called an "organ," and also a general description of the characteristics which have led to the names "great," "swell," "choir," etc., being applied to the sets of pipes respectively controlled by those keyboards. But the "swell organ" stands in a category by itself, and must be separately treated.

The name "swell organ" is applied to the sets of pipes played on by the swell manual, and controlled by the swell stops, because the whole of these pipes are shut up within a close box or framework of wood, the two walls of which box have a space between them filled in with sawdust or other material which will deaden the sound when the swell box is completely closed. In most swell boxes only one side is capable of being opened in any way, but when a large organ is so placed as to be open on all sides, the swell box can be opened by the organist on two sides. The side which can be thus opened is fitted with shutters, the gradual opening of which by the player's foot causes the body of tone of the pipes in the box to sound louder and louder as the shutters are more widely opened. There is usually at the right hand end of the pedal board, and just over it, a pedal called the "swell pedal," and when this pedal is gradually pressed down, the shutters of the swell box slowly open, and give to the sound a swelling or undulating sound, from which the name "swell organ" is derived. The swell pedal communicates by levers with the simple mechanism by which the shutters are raised and lowered.

We have said that the swell pedal is placed over the right hand end of the pedal board; but it is gradually becoming customary to put it in a position at or near the middle of the pedals. The advantages of this are obvious, as in this case the player can use either foot for the swell pedal while the other foot plays on the pedal keys. The old position of the swell pedal at the extreme right was bad, because it led players of mediocre powers to rely most on the left foot for pedalling, while the right was nearly always kept on the swell pedal to produce those "effects" which are so easily produced by working the swell pedal up and down, and thus keeping the right foot engaged while the left foot hopped from one pedal to another in the lower octave. We have seen pedals of which the lower keys were worn into grooves by too constant use, while above the middle pedal C the dust had thickly lodged on every single pedal. Every competent player can use both feet alike, and in real organ music he *must* do so; thus the placing of the swell pedal, or "shoe," in the middle is a distinct benefit to the two-footed player.

The shutters are usually put in that side of the swell box which faces the front of the organ. They are slabs of wood from six to ten inches broad and about one inch or one and a half inches thick, the length, of course, being equal to the width of the swell box. When the shutters are closed, the front of the swell box presents a solid appearance, just like the other sides, thus:

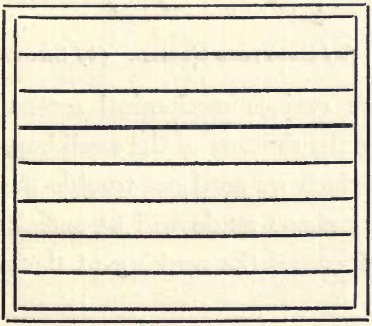


FIG. 36. SWELL BOX, SHUTTERS CLOSED.

But when the shutters are opened, it will be seen that their edges are bevelled, and those edges are covered with cloth so that as little sound as possible may escape when the shutters are closed. The shutters work on pivots inserted in their centre, which pivots work in proper places in the frame at each side. The following diagrams show the ends of two adjacent shutters (A) closed, and (B) open.

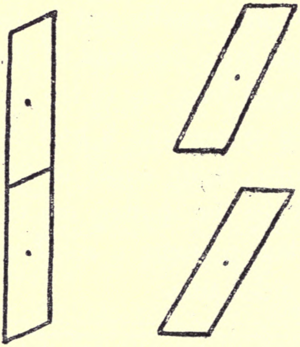


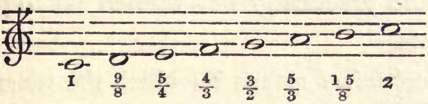
FIG. 37. *(a)* SHUTTERS CLOSED. *(b)* SHUTTERS OPEN.

There are various mechanical means of opening and closing the shutters of the swell box, with all the details of which we need not trouble the reader; but the remarks above made will be sufficient to enable him to understand the working of the swell box.

## CHAPTER XI.—TUNING THE ORGAN.

WE do not propose to enter here very deeply into the question of "temperament," beyond what is necessary to explain in general terms what is meant by "equal temperament," the system now generally adopted in tuning the organ.

All systems of temperament start from what is known as "just intonation," in which the vibration number of every diatonic note in the octave bears a certain and simple mathematical relation to the fundamental note or tonic. Thus an octave in just intonation would be as follows: the figures under each note above the tonic showing the mathematical relation of the vibration number of each note to the one of the tonic:



But if this method of tuning were adopted, while music in the key of C would be very pleasant to hear, all the other keys would be more or less out of tune, and the more remote from C was the key played in, the more out of tune it would be. In modern music changes of key, into even the most remote, are very frequent, and as all keys should therefore be equally in tune, it is necessary to "temper," or slightly alter the pitch of every note of the scale except the tonic and its octave. The octave is always tuned exactly to twice the number of vibrations of the tonic, and the octave is thus the only interval which is perfectly in tune on a keyboard instrument.

Some intervals are therefore flattened, and others sharpened, to get twelve exactly equal semitones in the octave, so that whatever be the key played in, it shall be as well "in tune" as any other key. This is called "equal temperament." Whether twelve exactly equal semitones in an octave have ever been achieved, is open to question; but, at all events, a well tuned organ in equal temperament is so near to the twelve equal semitones that it requires a very accurate and practically well trained ear to point out any defects.

The *mechanical* means by which the tuner accomplishes his object are as follows:

The larger open metal flue pipes usually have a sliding cap, which is moved up or down, according as the pitch is to be lowered or raised. Or there may be a slit in the back of the pipe, and by bending the two edges of this slit apart, and leaving an opening, the pitch is raised, and by putting the edges of the slit closer together it is lowered.

The *smaller* open metal flue pipes are altered in pitch by a tuning horn, made for the purpose, and in many sizes to fit the different sizes of the pipes. The larger ones are merely a hollow cone of brass (Fig. 38):

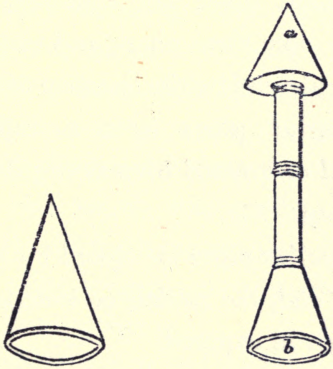


FIG. 38. TUNING HORNS.

while the smaller ones consist of a handle with a solid metal cone at one end and a hollow one at the other. With these cones the top of the pipe is opened out by driving in the one cone, or closed in by pressing the hollow cone over the metal of the pipe.

The larger open *wood* flue pipes are sharpened or flattened by cutting away or adding to the wood.

The *small* open wood flue pipes have a little metal shade fixed at the top of the back of the pipe. To flatten the pitch, the shade is bent down over the opening of the pipe; to sharpen it, the shade is raised.

The compound stops, say a three-rank mixture, have for each note three pipes, and to tune one the other two are silenced by the insertion of a little mop.

Stopped *metal* pipes have a cap, and the pitch is raised or lowered by pressing down or pulling up this cap.

Stopped *wooden* pipes are closed by a stopper inserted in the end, the raising or lowering of which alters the pitch as required.

*Reed pipes* are tuned by the tuning wire, which on being raised, lengthens the vibrating part of the reed and flattens it, and on being pushed down shortens the reed and sharpens it. The reed tuning wire is of this shape:

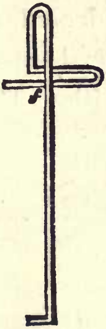
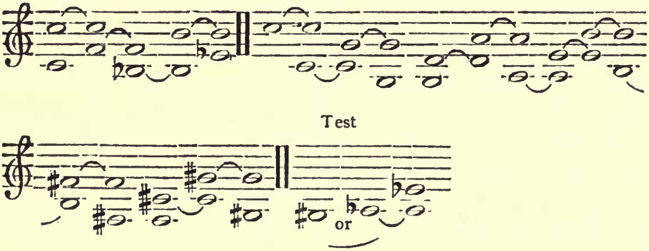


Fig. 39. The Reed Tuning Wire.

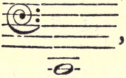
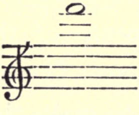
Heat or cold will often alter the pitch of organ pipes, especially the metal ones. It is well known that heat expands metals, while cold contracts them; thus on a hot summer night the metal pipes will lengthen and the tone grow slightly flatter, while a cold night will shorten and so sharpen the pipes. For this evil the only remedy is to apply artificial means for keeping the air in an organ as nearly as possible at about the same temperature—a matter which here does not further concern us.

The tuner's first step is to "lay the bearings," as it is called, which means tuning one octave or octave and a half first, so as to be able to tune the notes of every other octave in unison with that one of which the foundations or bearings are already tuned. This is done in the middle of the keyboard. The "scheme" usually adopted for "laying the bearings" in tuning in equal temperament is as follows, i.e., by octaves and fifths. The principal is the stop first tuned:



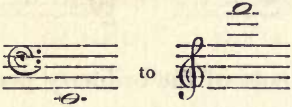
Tune tenor C, and from it the C an octave above. From that the F below; from the F the B flat a fifth below that; from that its octave, and from that upper B flat, tune the E flat an octave below it. Then proceed to tune the G a fifth above middle C, and so on until all the semitones have been put in tune. When the G sharp (A flat) is reached, try if it makes a fifth with the E flat tuned just before the first double bar. If this test comes out all right, all the fifths and thirds (major and minor) have been "tempered," so as to secure, as nearly as may be, twelve equal semitones in the scale, so that while *no* key is in "just intonation," all keys are equally pleasant to listen to. Tuning is, in fact, a compromise, so that the requirements of modern music in the way of change of key may be complied with. By "tempering" some notes, every key is put more or less "out of tune" as compared with the mathematically exact scale in "just intonation" given above, but the compensating advantage lies in the fact that in equal temperament all keys are, or should be, equally well in tune with each other. The different methods of "tempering" need not be here explained, as the subject lies outside our purpose, and to fully go into it would lead us wide of our purpose. The writer once played an organ in which the keys of C, G, D, A and F, B flat and E flat sounded much better than they would have done in equal temperament; but any key beyond three flats or three sharps was miserable to listen to; D flat or B natural was excruciating, while F sharp (G flat) was absolutely intolerable. This organ was so tempered as to favour the three sharp or flat keys, at the expense of those more remote from C. Equal temperament favours *no one key*, but makes them all, or tries to make them, equally bearable; and this is the temperament on which the vast majority of organs are now tuned.

# CHAPTER XII.—THE COMPASS OF THE ORGAN.

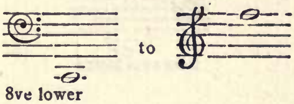
FEW questions in connection with the organ have been more hotly contested than the important one of what should be its proper *compass*. As this present work is intended only as a popular descriptive book dealing with the working details of the instrument, we have no space for a history of the great compass controversy. Nowadays, the lowest manual note is nearly always C, , and the highest either F,  or G, a note above, i.e., four octaves and a half or thereabouts, and it is this compass, including the *stops* which go below or above this range, with which we will now deal.

The compass of the manual *keys* may thus be stated, in general terms, as four and a half octaves, and the compass of the pedal *keys*, two and a half octaves; but these limits by no means express the compass of the organ. The longest pipe in even a very large organ is thirty-two feet, while the smallest is perhaps three inches only, which, as we shall see presently, gives a complete compass of about nine octaves.

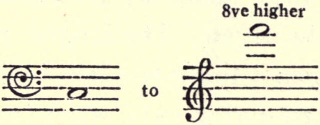
Taking the manual stops first into consideration, and beginning with the lowest manual note, C, the compass of the 8 feet stops will be from



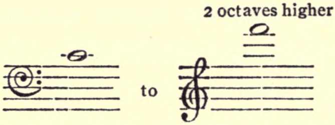
or four and a half octaves. But it is not uncommon to find a 16 feet stop on the manual, open or 8 feet stopped as the case may be (the *tone* being the same in both), and this makes the manual compass of this particular stop begin and end an octave lower than the 8 feet stop, thus:



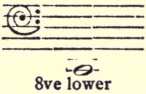
Again, take the principal stop (4 feet) on the manual, the lowest C of which is an octave higher than the C of the 8 feet pipes. The compass of the manual principal will thus be from



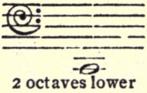
while of the compass of the fifteenth (2 feet) manual stop will be from



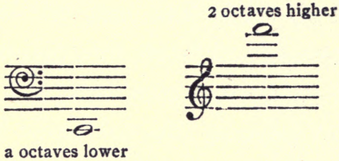
The lowest note of the ordinary pedal compass is, as already stated, the 16 feet C, or



but a 32 feet C is an octave lower than this, or



There are, of course, stops going higher than the fifteenth, but taking that, for our present purpose, as the upward limit, we shall find that from the 32 feet C to the highest note on the fifteenth stop, there is a compass of nine octaves.



The compass of each individual manual stop on the organ will be four-and-a-half octaves, and of each pedal stop two-and-a-half octaves, between these extreme limits, depending on whether it is a stop of 32 feet, 16 feet, 8 feet, 4 feet or 2 feet length for the lowest C on manual or pedal.

In every organ the 8 feet stops should largely preponderate, though this is not always the case; if they do not so preponderate, the balance of tone will be more or less interfered with.

# CHAPTER XIII.—THE CASE OF THE ORGAN.

THE main object of this book is to show the reader the *inside* of the organ; but though the outer covering or the "organ case," as it is called, is not an essential part of the instrument, yet, as it is often, or nearly always, made to carry a certain number of sounding pipes, some reference to it is necessary.

The case of the organ, looking at it from a vertical point of view, or from bottom to top, is generally divided into two main parts or "stories," the lower consisting of panelling, except where the keyboard is, and the upper of framework for various sets of pipes. These two parts are separated by a large moulding or other ornamental work. Above this division will be found such pipes as the architect's design of the case will allow the organ builder to place there.

The front of the case, and often the sides also, when the organ does not stand in a narrow recess, is divided into compartments, arranged in various ways, some of which we will proceed to illustrate. The most usual arrangements are these:

1. *Towers*, shaped either as portions of a circle, or as two sides of a triangle, when they are called "pointed towers." If the reader will remember that the circles in these figures represent roughly the diameters of the pipes and that the larger is the circle the greater is the length of the pipe, he will be able to form for himself a mental image of the shapes taken at the top by the various ranks of pipes arranged in the organ case. The next two figures show circular shaped and pointed towers:

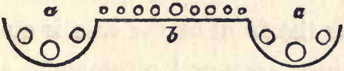


Fig. 39A. SEMICIRCULAR TOWERS.

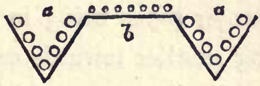


FIG. 40. POINTED TOWERS.

Sometimes there is a semicircular tower in the centre which is concave to the observer, as at *b* in the next figure, and in this case it is called not a "tower" but a "niche," thus:

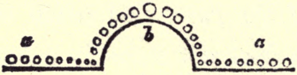


FIG. 41. A NICHE.

Again, a compartment may only curve outward slightly in the centre, when it is said to be "breasted":

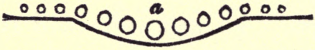


FIG. 42. A "BREASTED" COMPARTMENT.

Another design for the front of the case is of a "wavy" shape, and then it is called an "ogee" front:

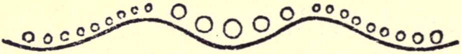


FIG. 43. THE OGEE.

At other times the front of the case is quite flat, with the larger pipes arranged alternately at the sides, the pipes growing smaller towards the centre, or vice versa, the larger pipes being in the centre, and the pipes growing smaller towards each side.

Whatever may be the stops which have part of their pipes in the case, the wind is carried to them by a conveyance tube to the foot of each pipe, these tubes being, of course, concealed by the woodwork of the case itself.

# CHAPTER XIV.—THE PITCH OF THE ORGAN.

THE question of what is the proper pitch to which the organ should be tuned has been the cause of almost as much discussion and difference of opinion as that of its compass.

The "pitch" of the organ means the number of vibrations per second of the column of air in the pipe, say, of the principal tenor C, to which the whole instrument is tuned. It may be here stated, in general terms, that any musical sound has three distinctive elements:

1. Its *pitch*, which is determined by the *number* of vibrations per second of the body producing it, be it a column of air or a vibrating string.

2. Its *loudness*, which depends on the *width* of those vibrations; and

3. Its *quality*, which depends on the *form* of the vibrations.

The pitch is the question we are now considering, and, assuming that the vibration number of tenor C to be 264 per second, the vibration number of the C an octave above it will be 528, that of the C below it 132; that of the G a fifth above it 396; and so on.

Now the question in connection with the organ is: what should be the vibration number of the tenor C to which the instrument is to be tuned? Should it be a low pitch, say, 248, a medium pitch, as 256, or a high pitch, as 264?

We hear sometimes of an organ being tuned to "concert pitch"; but what *is* concert pitch? Who shall say? Who *can* say? What authority shall decide?

It may be said at once that the case of the organ is very different from that of the pianoforte. There is no question that the efforts of the various leading pianoforte makers to gain increased brilliancy in the tone of their instruments, has led to a gradual but constant rise in the pitch at which the instruments are sent out; and it is equally certain that the pitch of the orchestra is now higher than it used to be. When we hear the plaintive A of the oboe blown for the orchestra to tune by, it is a higher A than our forefathers heard fifty years ago, or than the A which we ourselves may have heard even twenty years ago. And, of course, when an organ has to be played with the orchestra, as, for instance, at the Albert Hall, the Queen's Hall, or in any large concert hall, it must be tuned up (if it needs it) to the pitch of the orchestral instruments, and not the latter tuned down to the pitch of the organ.

But as the vast majority of organs in this country are not in concert halls, but in churches and chapels used for public worship, and for the express purpose of accompanying and supporting the mass of voices in the congregation, it would seem that the requirements of the human voice—by which we mean the ordinary voices of members of a congregation—should be the determining factor in settling the question of organ pitch. The organ is not like the pianoforte—to raise its pitch by a few vibrations does not increase to any perceptible extent the brilliancy of the tone of the organ; and the necessity of tuning the larger instrument to a higher pitch for the sake of brilliancy does not exist. The sole desideratum in fixing the pitch to which to tune a church organ is therefore the convenience of the voices—and not simply the voices of the choir, but the voices of the singing congregation.

We think even the composers of hymn tunes and the editors of hymnals do not always sufficiently consider the limits of the average voice. For example, that beautiful tune by Dr. Stainer to the hymn, "The roseate hues of early dawn," in "Hymns, Ancient and Modern," goes up to F sharp, which, with an organ at a high pitch, is quite a tone beyond that which the voices of a congregation can freely and comfortably reach. Again, to give just one more instance, that fine, solid old tune known as "French," or "Dundee," should never be in a higher key than E flat, because it goes to the upper E flat, and when some zealous hymnal editor puts it into F, it is a semitone too high for a congregation, even with an organ at a medium pitch. The ordinary adult voice which sings the melody, either a female voice which takes it as written, or a male voice which sings it an octave lower, can sing D or E flat with ease, but E natural is the limit, while F is a strain, and F sharp a severe strain.

Therefore, in determining the pitch of the organ to accompany a congregation, that congregation should be always considered first and foremost, and a low pitch, or at most, a medium pitch, chosen. The church organ, then, should never be tuned at a pitch higher than tenor C = 256 vibrations per second; and no tune, chant, or anthem should be selected to be sung by a congregation at even that pitch, if its melody goes higher than E natural.

# CHAPTER XV.—THE ELECTRIC ORGAN.

TO anyone who knows the tremendous pressure necessary to put down the keys of even a moderate-sized organ under the old system of trackers, etc., to the pallets—i.e., where penumatics have not been applied—it will not be surprising that attempts were made to apply electricity to do part of the work, as soon as the powers of that potent agent became generally known.

A copper wire will transmit power along the entire length of a church; it will carry that power round awkward corners and in all sorts of odd positions where mechanical appliances are almost impossible of application. A bundle of such copper wires, one for each key on each of four manuals, and each key on the pedal organ, can be wrapped up into one cable much less than two inches in diameter, attached to the console anywhere, and be connected with the interior of the organ in any position, so that the player can play in any convenient part of the church, and hear the effect of combined organ and choir as well as any member of the congregation.

Attempts were at first made to apply electricity to the pallet itself by an ordinary magnet and armature; but this attempt was not successful, the amount of power required being too great. Then the idea occurred to Mr. Barker of applying electric power for operating the pneumatic work of which he was the inventor. But before going into this question we will first explain the "relief pallets" which were invented to relieve the immense pressure required on the organ keys under the old system.

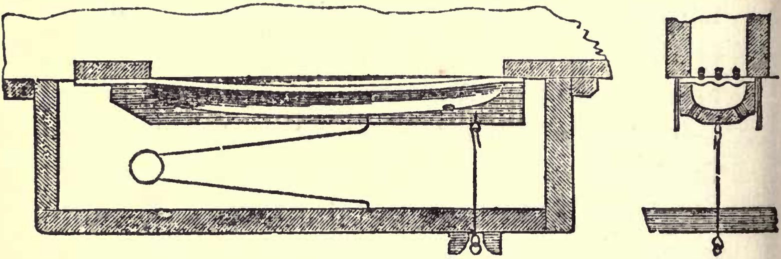


Fig. 44. Mr. Willis's Relief Pallet.

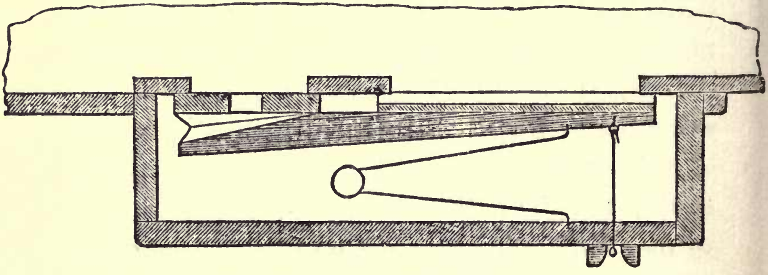


Fig. 45. Compensating Pallet

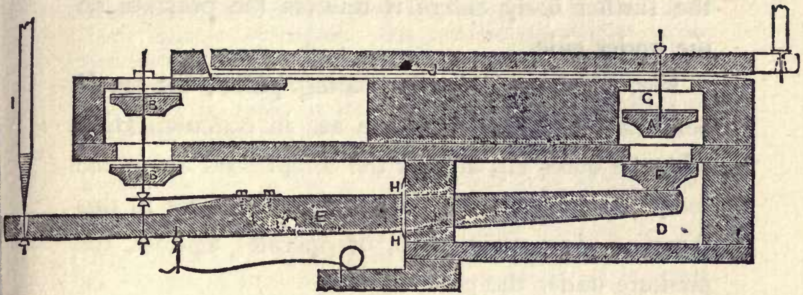


FIG. 46.

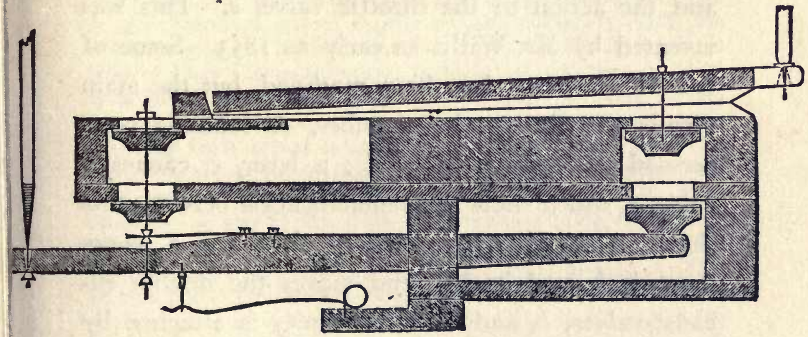


FIG. 47.

These four illustrations will serve to show the purpose and working of these relief pallets. The first, Fig. 44, shows a pallet invented by Mr. Willis, the famous organ builder, in 1861. The top of the pallet is hollowed out, leaving just enough surface to fit its seat; the air at first enters, and the pallet at once leaves its seat and offers little resistance; when the further body enters it relieves the pressure on the under side.

Fig. 45 shows a compensating pallet, the small bellows at the tail of which are in communication with the outer air, and as the compressed air in the sound-board collapses the bellows, the force in this direction does away with, or operates against, the pressure under the pallet.

Fig. 46 shows a section of one pneumatic lever, and the action of the throttle valve, *a*. This was invented by Mr. Willis as early as 1853. Some of the details have since been modified, but the main details are these: the chamber, *d*, contains compressed air from a reservoir; a lever, *e*, carries a valve, *f*, which shuts off communication between this chamber and the one above, *g*; the lever, *e*, works through *h*, and its left end moves the double exhaust-valves, *b*, and at its extremity is attached by a tracker, *i*, to the tail of the key. Fig. 47 shows the bellows distended.

The following description of Mr. Barker's invention are copied from Rimbault and Hopkins's book on "The Organ":

> It was in 1832 that Mr. Barker, then established as an organ builder in Bath—his native city—was led to reflect on the serious inconvenience arising from the extreme heaviness of touch in all large organs, and as more particularly

exemplified in the one then but recently constructed for York Minster Cathedral. His persevering studies having revealed to him an efficacious remedy of this defect, by the invention of what has since been called the pneumatic lever, he wrote, in 1833, to Dr. Camidge, then organist of the cathedral, announcing his discovery, and begging to be allowed to give a proof of its efficacy, by applying it in a temporary way to one of the heaviest keys of the organ. Dr. Camidge in his reply wrote: "To such an instrument as ours it (i.e., the discovery) would most certainly be very important, where four organs have to be played occasionally by *one* set of keys, and I should be most happy to recommend its adoption. Mr. Hill, of the late firm of Elliot and Hill, has erected our organ, and, I assure you, the playing it is no sinecure; on the other hand, it is most laborious work to go through a grand chorus or last voluntary with the whole power of the instrument. Such a difficult touch as that of York Cathedral organ is doubtless sufficient to paralyse the efforts of most men, I assure you. I, with all the energy I rally about me, am sometimes inclined to make a full stop from actual fatigue in a very short time after the commencement of a full piece." Notwithstanding Dr. Camidge's wish and recommendation, financial difficulties stood in the way of Mr. Barker's invention being adopted in York; nor was he more successful in his proposition for applying it to the Birmingham organ opened in 1834 or 1835. It was about this period that the eminent French builder, M. Cavaillé, was occupied in building a colossal organ for the royal church of St. Denis, near Paris, and it was already sufficiently advanced to convince Mr. Barker that, for heaviness of touch, it would rival or even surpass the York Minster and Birmingham organs in their then conditions; indeed, it might have been fairly questioned, whether any organist of acknowledged talent would risk his reputation by attempting to play it. Mr. Barker heard from a friend who visited the Continent occasionally that such an instrument was building, and Mr. Barker wrote immediately to M. Cavaillé to propose the introduction of his pneumatic lever, accompanying his letter with a certificate from his since lamented friend, Mr. Merrick, who had played on a small instrument Mr. Barker had fitted up for demonstration, each key of which presented a resistance of several pounds. This was in 1837. M. Cavaillé replied, engaging Mr. Barker to go over to France, and examine the possibility of applying his invention to the magnificent organ in question. Mr. Barker visited Paris, and the application was decided on, under his immediate superintendence. However, in order to establish his priority as inventor, and protect at the same time his interests, previous to doing anything more in the matter, he took out, in 1839, a French patent, and soon after the pneumatic lever was applied with the greatest success, and for the first time, to the St. Denis organ. After having passed an agreement with M. Cavaillé to grant him licence, under Mr. Barker's patent, as he might require, and which led to its application to the organs in St. Roche, La Madeleine, St. Vincent de Paul, etc., Mr. Barker's connection with M. Cavaillé ceased, and he then was led to undertake the direction of a large organ building establishment recently formed in Paris, under the name of Daublaine and Callinet, and where he had frequent opportunities of introducing his invention. This company having been dissolved about 1845, Mr. Barker undertook to carry on the concern for a M. Ducroquet, a capitalist who had purchased it, and built for him, among other important instruments, that of St. Eustache, as also the small but very complete organ which appeared in the French department of the London Universal Exhibition of 1851, and for which M. Ducroquet received, in addition to the English prize medal, his nomination of Chevalier of the Legion d'Honneur from the French Government.

Reverting to the English Exhibition of 1851, Mr. Barker's French organ presented, for the first time, a *complete* specimen of the application of the pneumatic lever to the fingerboards--that is to say, including the unison, octave and sub-octave couplers. Mr. Hill exhibited an organ in which the pneumatic lever was applied to the draw-stop action only; and Mr. Willis, a large organ in which the lever was applied both to the key and draw-stop action, but to the former without acting on the couplers.

From this time the advantages of the pneumatic application were more appreciated; and the adoption of the system became more frequent in England, France and Germany.

In fact, workmen who had been familiarised with the construction of the lever in the workshops of M. Cavaillé, lent aid and assistance in England, so that when Mr. Barker proposed to take out—alas! too late—a patent in this country, he found he would be only bringing coals to Newcastle.

At length came the great Paris Exhibition of 1855, to which Mr. Barker was admitted as an exhibitor on his own account, independently of M. Ducroquet, who was on the point of retiring from business, but for whom Mr. Barker had built for the last time and for the exhibition, an organ of twenty stops, three manuals and separate pedal organ in which the pneumatic lever was turned to good account, and enabled him to place all the powerful reeds of the great organ in the swell box, and to obtain by that means unusual powers of *crescendo*. At the close of the exhibition, he was honoured with a first class medal and his nomination as Chevalier in the Imperial Order of the Legion d'Honneur.

Mr. Barker cannot, in this rapid and imperfect biographo-historical sketch respecting the pneumatic lever, pass over in silence the claims of priority which have been put forth by other parties to the invention. In the first place, that of Mr. Joseph Booth, organ builder in Wakefield, and who, it is alleged, introduced a contrivance of this nature into the Brunswick Chapel organ in Leeds in 1827.

A small bellows, called a puff valve, is said to have been placed in connection with one of the double grooves of the sound-board, and by its inflation, on one of the pallets being drawn, to have acted automatically on the second. In suffering this description to be correct, there would be evidently here the germ of the pneumatic lever, as in the early trials of Papin was contained implicitly that of the steam engine, perfected later by Watt, Stephenson and others, but in the one as in the other case, how great the distance which separates the elementary fact from its ultimate results—how great the difficulties to be overcome. Free to admit that Mr. Booth was in possession of a fruitful idea, he kept his light so completely under a bushel, that, sterile in its consequences, no one heard of it till twenty-four years after, when it had long ceased to exist. It is superfluous to say that Mr.

Barker had no previous knowledge of this attempt or any other in the direction of his pneumatic lever, which, it is well known, constitutes in the organ as constructed by him a motive power directed by the finger of the performer *to all* the mechanical parts of the instruments. The foregoing remarks are, in part, equally applicable to the pneumatic apparatus of Mr. Hamilton, but with this difference, that this gentleman does not substantiate any claim to an application anterior to 1835, two years later than Mr. Barker's correspondence with Dr. Camidge. It might seem, in the presence of the comparatively satisfactory results obtained by the pneumatic lever, that, as a means of facilitating execution on large instruments, nothing better could be wished for. This, however, is not so absolutely the case as might be inferred at first view, as will fully appear from the following considerations. The great defect of the organ, and especially large instruments with several keyboards, lies in the number and excessive complication of its mechanical parts, all of which, however, accurately adjusted, are, from their nature, particularly subject to the effects of atmospheric, or to speak more exactly, hygrometric influence. Thus, under the effect of damp, the long trackers lengthen, the levers swell and move with difficulty on the bearings. The solid framing which supports the sound-boards and the mechanism adds by its swelling or shrinking to the general disorder; and every organist is aware that in summer the touch of his instrument is often reduced to zero, whilst in winter it is deepened, and he is exposed to continual cypherings. To remedy as far as possible these serious inconveniences, the parts of attachment of the various mechanical parts of the instrument are provided with regulating screws and nuts, by which means the virtual length of these organs of transmission may be *integralement* established when changed. But how many difficulties to be got through before accomplishing this labour of Sisyphus, which is *considerably increased* by the introduction of the pneumatic lever and its couplers. It occurred to Mr. Barker, as it already had to many others, that seeing what has been accomplished in telegraphy, by which the most delicate movements are transmitted to indefinite distances, with rapidity and precision, it might be possible to apply the same principle to the organ, in which the keyboard represents the manipulator and the pallets of the organ the receptors of the telegraphy *bureaux*. Now this has been actually and successfully accomplished by Mr. Barker in presence of repeated and uniform failure on the part of his predecessors. The reasons for this will appear in the course of the explanations of his system, as applied by Mr. Barker in France to the large St. Augustin organ, in which the keyboards have not offered the slightest derangement although the instrument has been erected more than a twelve-month, and, consequently, has been during that time subject to great vicissitudes of temperature. The applications of Mr. Barker's patent in England by Messrs. Bryceson Brothers and Company have been equally successful.

An essential condition in the electric transmission in the organ, and which had been generally overlooked by Mr. Barker's predecessors in this direction is to diminish the resistance of the pallets to a minimum by means of a peculiar construction, or to attack them by the intervention of a pneumatic lever reduced to a simple inflating bellows and debarrassed of all its usual accessories in the shape of couplers, etc., which can now be all affected electrically.

This new system offers three inestimable advantages in its application:

1. A great simplification by the suppression of a multitude of moving parts, replaced by simple insulated wires.
2. The possibility of transmitting the movements to any required distance irrespective of the relative positions of the organ and its keyboard.
3. The invariability of the keyboards under the greatest changes of temperature.

It is now about five years since Mr. Barker made his first experiment for the application of electricity to the organ, and proposed applying it to the large organ which he had just received the order to construct for the church of St. Augustin, upon the favourable report of the commission charged to examine the new mode of construction. This organ was opened about three months since, and the commission having made another and final report in most favourable terms, Mr. Barker is now charged with the construction of another large organ for the new church of St. François de Xavier, which, with those of St. Augustin, Salons and Montrouge, is the fourth application of the electric principle in France.

It would occupy too much space to give details of the various improvements which have taken place in the application of electricity to the organ. The latest word in this department has up to now been said by Mr. Hope-Jones, whose name is well known in connection with electric organs. We give a few illustrations of his apparatus, which will explain the general principles on which he worked.

But the idea of "relief" was entertained long before this, for the notion of applying electricity to organs is coeval with the invention of the electric telegraph. The earliest efforts in this direction were probably those made by William Wilkinson, the founder of the firm of Wilkinson and Sons, the well-known organ builders of Kendal, who, soon after the invention of the electro-magnet in 1826 tried to govern pallets by the electric current, but his methods turned out to be too heavy and troublesome, and the idea was abandoned.

Dr. Gauntlett in 1851 proposed to play all the organs at the Great Exhibition either separately or combined, from a common console, but the committee would have none of it. One of them told Gauntlett that they would not have music, as the exhibition was intended for higher purposes. Dr. Gauntlett took out a patent, and a short sentence in the description of that patent contained a few words which proved the seed of all that followed in the way of the application of electricity to pneumatics: "The apparatus known as the 'pneumatic lever' may be worked with magnets and armatures."

In 1863 J. W. Goundry took out a patent for "the application of electro motive power to organs and other similar keyed instruments, whereby the ordinary movement of the same may be entirely superseded."

A definite move was made when Dr. Peschard, the organist of St. Etienne, Caen, began to experiment with electro-pneumatics in 1860, and got into touch with the famous Barker in 1861. A year or two later (1864) Peschard took out a patent of which Dr. Audsley ("Art of Organ Building," page 707) says in it were "set forth for the first time in the annals of the organ builder's art, the principle on which all subsequent electro-pneumatic actions are founded which operate the pallets of the ordinary pallet and slider wind chest."

In 1868 came the patent of Charles Spackman

Barker, so well known in connection with pneumatic improvements. The following diagram shows the working of this patent, which the intelligent reader will comprehend without any detailed description:

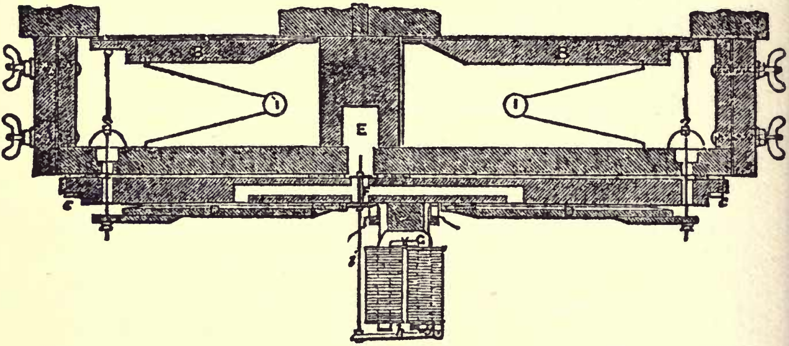


FIG. 48. MR. BARKER'S ELECTRIC AND PNEUMATIC ACTION.

The patent of Schmoele and Mols, of Antwerp, taken out in 1881, showed a still further advance in the application of electricity to the organ.

But all these contrivances, clever and ingenious though they were, had their drawbacks. They were, the earlier ones especially, very expensive to set up and keep up, and they were not reliable. Mr. G. L. Miller, author of "The Recent Revolution in Organ Building,"* tells us that in 1889 he asked Mr. W. T.

---

* "The Recent Revolution in Organ Building." By George L. Miller, F.R.C.O. London, W. Reeves, 1913.

Best to go and see the electric organ at St. John's, Birkenhead, built by Mr. Hope-Jones, whose electric organs are now the latest word in this department. Best went and ridiculed the idea that any good could come out of an electric action. He said he did not want to see any more electric organs. But events have proved Best's judgment to have been wrong. As dealt with by Mr. Hope-Jones, the electric organ is now an accomplished, fact and superior in every way to any tracker or mere pneumatic action ever invented. Best himself, were he still alive, would probably be the first to admit that his opinion of a quarter of a century ago wanted considerable revision.

It would serve no useful purpose to trace in detail the various advances made by Mr. Hope-Jones since his first electric organ was built. Like all other inventors and improvers, he had to learn as he went along, but a glance at his invention as it now stands will show that he has learned to some purpose.

To make his invention clear to the reader who only wants a "general notion" of the latest method of applying electricity to the organ, we cannot do better than quote from the lucid work of Mr. G. L.

Miller above referred to. At page 33 *et seq.*, of his book, he says:

"The working is as follows: the box A is connected with the organ bellows and so (immediately the wind is put into the organ) is filled with air under pressure, which passes upwards between the poles of the magnet N. Lifting the small iron disc J, it finds its way through the passage L into the small motor M, thus allowing the movable por-

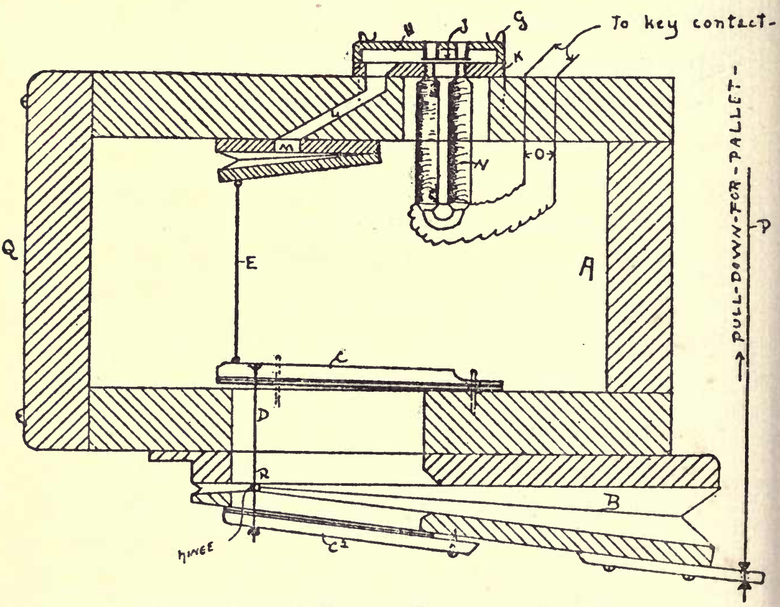


Fig. 49. The Electro-Pneumatic Lever.

tion of the motor M to remain in its lower position, the pallet C$^1$ being closed and the pallet C$^2$ being open. Under these conditions, the large motor B collapses and the pull-down P (which is connected with the organ pallet) rises.

"When a weak current of electricity is caused to circulate round the coils of the electro-magnet N, the small armature disc J is drawn off the valve-seat H on to the zinc plate K.

"The compressed air from within the small motor M escapes by way of the passage L, through the openings in the valve seat H into the atmosphere. The compressed air in the box A then acts upon the movable portion of the small motor M in such a manner that it is forced upwards and caused (through the medium of the pull-wire E) to lift the supply pallet C$^1$ and close the exhaust pallet C$^2$, thus allowing compressed air to rush from the box A into the motor B and so cause this latter motor to open and (through the medium of the pull down P) to pull the soundboard pallet from its seat and allow wind to pass into the pipes.

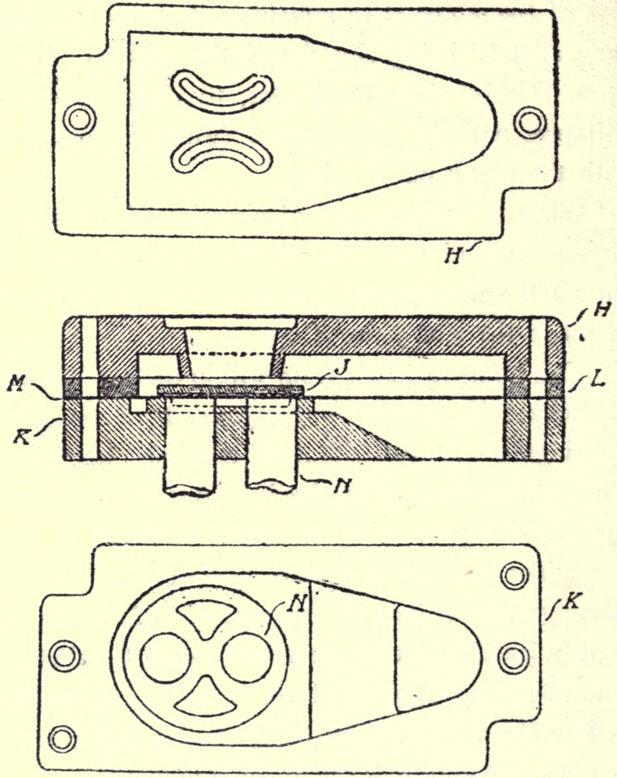


Fig. 50. Valve and Valve-Seat, Hope-Jones Electric Action.

"The valve-seat H has formed on its lower surface two crescent-shaped long and narrow slits. A very slight movement of the armature disc J, therefore, suffices to open to the full extent two long exhaust passages. The movement of this disc is reduced to something less than the $\frac{1}{100}$ part of an inch. It is, therefore, always very close to the poles of the magnet, consequently a very faint impulse of electricity will suffice (aided by gravity) to draw the disc off the valve-seat H. The zinc plate K being in intimate contact with the iron poles of the magnet N, protects the latter from rust by well-known electrical laws. All the parts are made of metal, so that no change in the weather can affect their relative positions. R is the point at which the large motor B is hinged; G is a spring retaining cap in position; O the wires leading from the keys and conveying the current to the magnet N; Q the removable side of the box A.

"Fig. 50 represents a larger view of the plate K in which the magnet poles N are rigidly fixed—of a piece of very fine chiffon M (indicated by a slightly thicker line) which prevents particles of dust passing through so as to interfere with the proper seating of the soft Swedish charcoal iron armature disc J—of the distance piece L and of the valve-seat H.

"On the upper surface of this valve-seat H another piece of fine chiffon is attached to prevent possible passage of dust to the armature valve J, from outside.

"As all parts of this apparatus are of metal, changes in humidity or temperature do not affect its regulation."

One grand feature of the application of electricity is the fact that "composition pedals," to push out and in certain groups of stops, are entirely done away with. If the reader will look at the following engraving from Mr. Miller's chapter on "Stop-Keys," he will see in the curve above the top manual a num-

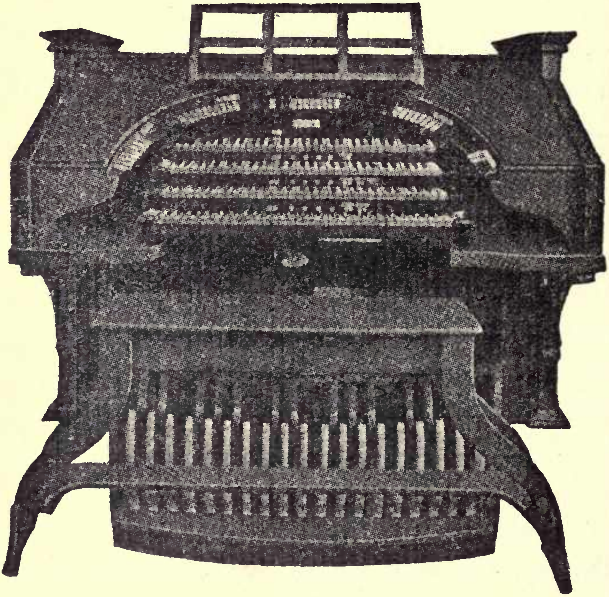


Fig. 51. Console, Showing the Inclined Keyboards First Introduced into this Country by Robert Hope-Jones.

ber of ivory keys. These electrically govern the stops in various groups on the pedal and manual organs, and the player, in a fraction of a second, can run his finger-nail along the desired keys, and thus bring into action the stops he wants to use.

It has been well and truly said that there is no finality in organ building. It is difficult to see what further even electricity can do for the organ; but when we compare the first locomotive with a Great Northern express engine, a Montgolfier balloon with an aeroplane, or a "growler" with a powerful Daimler, it would be rash to say that nothing further can be done. In this department, as in so many others, we must "wait and see."

---

Printed by The New Temple Press, Norbury Crescent, London, S.W.16.

LIBRARY
MAR
22
1982
UNIVERSITY OF TORONTO

# Selections from Catalogue of
# WILLIAM REEVES, BOOKSELLER LTD.,
# 83 Charing Cross Road, London, W.C.2.

(*All prices quoted are net and postage extra.*)

**STUDIES IN RUSSIAN MUSIC** (Glinka, Mussorgsky, Borodin, Rimsky-Korsakov, Balakirev, Tchaïkovsky). By GERALD ABRAHAM, *author of* "Borodin and His Music." Many Musical Examples. Crown 8vo, cloth. *Nearly Ready.*

**HISTORY OF THE TRUMPET** of Bach and Handel, and its Music from its earliest use as an Artistic Instrument to the middle of the Eighteenth Century. Special reference given to its employment by Bach and Handel and the Correct Modern Performance of the Old Parts, including a description of the New Instruments invented by the Author for this purpose. With Plates and Music Supplement, by W. MENKE. Englished by GERALD ABRAHAM. English and German Text together. Thick crown 8vo, cloth, 10s.; paper covers, 7s. 6d.

**BEETHOVEN'S PIANO SONATAS.** A Descriptive Commentary on the Sonatas in the Light of Schnabel's Interpretations, giving an Æsthetic Appreciation of each Sonata, with an Outline of the Development of the Sonata Form in Beethoven's hands. With a Biographical Sketch of Schnabel and an account of his activity as an executant, composer and teacher. By RUDOLF KASTNER. Englished by GERALD ABRAHAM. 55 pages, post octavo, cloth, 3s.

**ELIZABETHAN VIRGINAL MUSIC** and Its Composers. *New Issue embodying recent additional Discoveries* (1934) in the Index of Virginal Composers and their Works. My MARGARET H. GLYN. Cloth, 10s.

**CHOPIN THE COMPOSER** and his Music. An Analytical Critique of Famous Interpretations. By JOHN F. PORTE. Crown 8vo, cloth, 5s. 6d.

**VIOLINIST'S MANUAL.** A Treatise on the Construction, Choice, Care, Adjustment, Study and Technique of the Violin. Full of Useful and Practical Advice regarding Violin and Bow. By H. F. GOSLING. Numerous Illustrations and an Index. Crown 8vo, cloth, 7s. 6d.; paper covers, 5s. 6d.

**ORCHESTRAL AND BAND INSTRUMENTS.** A Short Account of the Instruments in the Orchestra and in Brass and Military Bands. By G. F. BROADHEAD, *Mus.B. Dunelm, L.Mus.T.C.L.* With 24 Illustrative Music Examples. Crown 8vo, cloth, 3s.; paper, 2s.

**BRAHMS' CHAMBER AND ORCHESTRAL MUSIC.** Historical and Descriptive Account of each Work, with Exhaustive Structural, Thematic and Rhythmical Analyses, and a Complete Rhythmical Chart of each Movement. By EDWIN EVANS. Copiously Illustrated in Music Type. First Series, to Op. 67. Thick 8vo, cloth, 16s. 6d. Second Series, Op. 68 to the end. *Ready close of* 1935. Probable price, 16s. 6d.

**BEETHOVEN AND HIS PIANO WORKS** (Sonatas, Concertos, Variations, etc.). Descriptive and Analytical Aid to their Understanding and Rendering. By HERBERT WESTERBY, *Mus.Bac.* With Music Examples and Illustrations. Greatly enlarged edition. Crown 8vo, cloth, 4s.

**PRACTICAL GUIDE FOR THE CONDUCTOR** and Useful Notes for the Orchestra. By F. W. DE MASSI-HARDMAN. With Music Examples and Diagrams. 2s.

**CHAMBER MUSIC** and its Masters in the Past and in the Present. By N. KILBURN, Mus.Doc. With Plates and Illustrations. New edition, revised and with additional chapters by G. E. H. ABRAHAM. Numerous Portraits and Music Examples. Cr. 8vo, cloth, 7s. 6d.

**MENDELSSOHN'S "SONGS WITHOUT WORDS."** How to Interpret Them. Gives the Piano Student Helpful Insight into the First Principles of Form in Music. A readable and useful Guide for all. Crown 8vo, cloth, 4s.; paper covers, 2s. 6d.

**THE BOWED-HARP.** A Study in the History of Early Musical Instruments, by OTTO ANDERSSON, Ph.D. (President of the Swedish University at Abo). From the original Swedish Edition, revised by the Author. The Translation edited with additional footnotes by KATHLEEN SCHLESINGER. 116 illus. Thick 8vo, cloth, 21s.

## STUDIES IN THE MUSIC OF THE MIDDLE AGES.

**HISTORICAL FACTS FOR THE ARABIAN MUSICAL INFLUENCE.** By H. G. FARMER, M.A., Ph.D. Thick crown 8vo, cloth, 12s. 6d.

**PHILOSOPHY OF VOCAL CULTURE.** A Textbook of Vocal Training and Preparation for Song Interpretation, with a Section showing how to Determine Accurately the Special Suitability of Songs selected for particular Vocal Requirements by Pitch and Melodic Curve Graphs. By FRANK PHILIP. Music Illustrations and Descriptive Diagrams. Thick 8vo, cloth, 8s. 6d.

**NATURAL TECHNICS IN PIANO MASTERY.** Æsthetic Evolution from Student to Artist. All Vital Points Discussed and made Clear. Many Diagrams of Hand and Finger Technique, and some Music Examples. By J. EISENBERG. Crown 8vo, cloth, 7s. 6d.

**PRINCIPLES AND METHOD OF SINGING-CLASS TEACHING.** With a Course of Outline Lessons as Examples for the Use of Teachers. By Granville Humphreys, Professor of the Art of Teaching, Voice Production, etc., at the T.S.-F.C.; late Lecturer in Class-Singing at the Training School for Music Teachers. Numerous Music Illustrations. Crown 8vo, cloth, 5s. 9d.; paper, 4s.

Teachers will find this very striking book of great value. The publishers have no hesitation in strongly recommending it.

**ORGAN OF THE ANCIENTS FROM EASTERN SOURCES** (Hebrew, Syriac and Arabic). By Henry George Farmer. With Foreword by Rev. Canon Galpin. Numerous Illustrations. Square 8vo, cloth, 15s. 6d.

**THE AMATEUR VOCALIST.** A Guide to Singing. With Useful Hints on Voice Production, Song Preparation, etc. By W. L. Twinning, F.R.C.O. Foolscap 8vo, limp cloth, 1s. 6d.

**MODERN ORGAN BUILDING.** Being a Practical Explanation and Description of the Whole Art of Organ Construction, with Especial Regard to Pneumatic Action. Together with Chapters on Tuning, Voicing, etc. By Walter and Thomas Lewis (Organ Builders). With seventy-six Illustrations drawn to Scale and Reproduced from Actual Working Drawings, together with Diagrams, Tables, etc. Second edition, enlarged both as to Text and Illustrations. 4to, extra gilt cloth, 17s. 6d.; or cloth, 15s. 6d.

**ORCHESTRAL WIND INSTRUMENTS**, Ancient and Modern. Being an Account of the Origin and Evolution of Wind Instruments from the Earliest to the most Recent Times. Illustrated with Plates specially prepared for this Work, giving sixty-one Examples of Instruments (or parts) described. By Ulric Daubeny. Important original work, fully illustrated with beautiful reproductions taken from Fine Photographs of the Actual Instruments. 8vo, cloth, 12s. 6d.

**ART OF TUNING THE PIANOFORTE.** A New and Comprehensive Treatise to enable the Musician to Tune his Pianoforte upon the System founded on the Theory of Equal Temperament. By Hermann Smith. New edition, thoroughly revised. Crown 8vo, limp cloth, 3s.

**FRANZ SCHUBERT**, Man and Composer. The Centenary Biography. A Vivid Story of a Charming Personality. By C. Whitaker-Wilson. Portraits and Illustrations of Schubert and his Friends. Handsome volume, thick crown 8vo, cloth. 10s.

**QUESTIONS ON MOZART'S SONATAS**, both Educational and Suggestive. By F. Helena Marks. Aid and Companion to the Study of the Author's work, "The Sonata: Its Form and Meaning as Exemplified in the Piano Sonatas by Mozart." For Teachers and Students. 1s. 6d.

**ESSENTIALS IN MUSIC STUDY FOR EXAMINATIONS.** A Helpful Guide both for the General Student and Candidates for Junior and Intermediate Examinations. By Rev. E. H. Melling, F.R.C.O. Cloth, 2s. 8d.; paper covers, 1s. 6d.

**WITH THE GREAT COMPOSERS.** A Series of Pen Pictures, exhibiting in the form of Interviews the Personal Characteristics as Artists of the World's great Tone Poets. By Gerald Cumberland. Portraits. Crown 8vo, cloth, 7s. 6d.

**HOW TO LISTEN TO GOOD MUSIC** and Encourage the Taste in Instrumental and Vocal Music. With many useful Notes for Listener and Executant. By K. Broadley Greene. Complete, cloth, 4s. 6d.; or in two books, paper, 1s. 6d. each.

**A CRITICAL STUDY OF BEETHOVEN'S NINE SYMPHONIES,** with a Few Words on His Trios and Sonatas, a Criticism of "Fidelio" and an Introductory Essay on Music. By Hector Berlioz. Translated from the French by Edwin Evans, Senior. Portrait. Crown 8vo, cloth, 5s. 6d.

**THE RISE AND DEVELOPMENT OF MILITARY MUSIC.** By Dr. H. G. Farmer. With Illustrations of Early Instruments and Musical Examples, and Short Biographical Notices of many Staff Bandmasters. Preface by Lieut A. Williams, M.V.O., Mus.Doc., Bandmaster of Grenadier Guards. Crown 8vo, cloth, 5s. 6d.

**SOME FAMOUS SYMPHONIES,** How to Understand Them. With their Story and Simple Analysis. References also to Gramophone Records, numerous Portraits. By J. F. Porte. Dealing with Symphonies of Beethoven, Berlioz, Borodin, Brahms, Chausson, Dvorák, Elgar, César Franck, Haydn, Mendelssohn, Mozart, Schubert, Stanford and Tchaïkovsky. Complete in cloth, 5s.; or in two separate parts, paper, 1s. 6d. each.

**GLUCK AND HIS OPERAS.** With an Account of their Relation to Musical Art. By Hector Berlioz. Translated from the French by Edwin Evans, Senior. Crown 8vo, cloth, 5s. 6d.

**HANDBOOK TO THE VOCAL WORKS OF BRAHMS.** An Historical Descriptive and Analytical Account of the Entire Vocal Works of Johannes Brahms. Treated in the Order of their Opus Number. Preceded by a Didactic Section and followed by Copious Tables of Reference. For the Use of Concert-Goers, Pianists, Singers and Students. By Edwin Evans, Snr. Thick 8vo, cloth, 15s.

**MEZZOTINTS IN MODERN MUSIC.** Critical Essays on Brahms, Tchaïkovsky, Chopin, Strauss, Liszt and Wagner. By Jas. Huneker. Third Edition. Crown 8vo, cloth, 8s. 6d.

**THE SYMPHONY WRITERS SINCE BEETHOVEN.** Critical Essays on Schubert, Schumann, Götz, Brahms, Tchaïkovsky, Brückner, Berlioz, Liszt, Strauss, Mahler, Mendelssohn, Saint-Saëns, etc. By Felix Weingartner. Translated by A. Bles. Twelve Portraits. Second Impression. With Chapter added by D. C. Parker on Weingartner's Symphony No. 5. Crown 8vo, cloth, 7s. 6d.

**MUSIC AND MUSICIANS.** Essays and Criticisms, by Robert Schumann. Translated, Edited and Annotated by F. R. Ritter. Portrait of Robert Schumann, photographed from a Crayon by Bendemann. First Series, Seventh Edition. Thick crown 8vo, cloth, 419 pages, 8s. 6d.

*Ditto.* Second Series, Third Edition. Thick crown 8vo, cloth, 540 pages, 10s. 6d.

**MUSIC AND THE HIGHER EDUCATION.** Art a Necessity in the College World. The Teacher's Preparation and his Method. By Edward Dickinson. Crown 8vo, cloth, 7s. 6d.

**ESSENTIALS IN PIANO-PLAYING AND OTHER MUSICAL STUDIES.** By J. Alfred Johnstone, Hon. L.Mus.T.C.L. Portrait, 243 pages. Crown 8vo, cloth, 5s. 6d.

**THE ART OF LISTENING TO AND APPRECIATING GOOD MUSIC,** or the Education of a Music Lover. By Professor Edward Dickinson *(author of* "The Growth and Development of Music," etc.). 293 pages, crown 8vo, cloth, 7s. 6d.

**EXAMINATION TEST QUESTIONS.** Containing spaces for the Pupils' Written Answers. By Walter L. Twinning, F.R.C.O. No. 1, Musical Notation and Time, 7d. No. 2, Formation of Scales, 6d. No. 3, Ornaments, 7d. No. 4, Intervals, 7d.

**CANDIDATE'S SCALE AND ARPEGGIO TESTS** for the Piano. By Wilson Manhire, L.R.A.M. 9d.

**PAN PIPES. THE SPIRIT OF MUSIC** from East to West in Nature, Art and Legend. Penned in Sixteen Articles for General Reading, with some Drawings of Eastern Musical Instruments. By G. P. Green (author of "Some Aspects of Chinese Music"). Crown 8vo, cloth, 4s. 6d.

**THE GIPSY IN MUSIC.** By Franz Liszt. Englished for the first time by Edwin Evans, Senior, and preceded by an Essay on Liszt and his Work.

Gipsy and Jew, Two Wandering Races.
Gipsy Life in Relation to Art.
Gipsy Music and Musicians.

The result of the Author's long Experience and Investigations of the Gipsies and their Music. With Portraits of the Author, etc. In two handsome volumes, cloth, 16s. 6d.

**THEORY OF MUSIC FOR YOUNG MUSICIANS.** With Answers given to all the Questions, and a Dictionary of necessary Musical Terms. By Mary Sharp. Limp cloth, 1s. 6d.; paper covers, 1s.

**TREATISE ON BYZANTINE MUSIC.** By the very Rev. S. G. Hatherly, Mus.Bac. Oxon., Protopresbyter of the Patriarchal Œcumenical Throne of Constantinople. With Music Examples throughout. 162 pages. 4to, cloth, 10s.

**ARABIC MUSICAL MANUSCRIPTS IN THE BODLEIAN LIBRARY.** Plate of two Musical Instruments from early Arabic Manuscripts. By H G. Farmer, M.A., Ph.D. 8vo, sewed, 3s.

**HISTORY OF RUSSIAN MUSIC.** By M. Montagu-Nathan. Being an Account of the Rise and Progress of the Russian School of Composers. With a Survey of their Lives and a Description of their Works. Frontispiece. Thick crown 8vo, cloth. Second edition, revised. 8s. 6d.

**POLISH MUSIC AND ITS COMPOSERS.** A Historical Account from 995 to the Present Time, including Chopin and his Works. By E. Rayson. Four portraits. Square 8vo, cloth, 3s.; paper, 2s.

**THE WORLD'S EARLIEST MUSIC.** Traced to its Beginnings in Ancient Lands. By collected Evidences of Relics, Records, History and Musical Instruments, from Greece, Etruria, Egypt, China, through Assyria and Babylonia to the Primitive Home, the Land of Akkad and Sumer. By Hermann Smith. With sixty-five full page illustrations and cuts, nearly 400 pages. Crown 8vo, cloth 10s.

**THE MUSIC OF THE MOST ANCIENT NATIONS.** Particularly of the Assyrians, Egyptians and Hebrews; with special reference to discoveries in Western Asia and in Egypt. By Carl Engel. With numerous Illustrations and Index. Thick 8vo, cloth, 18s.

The above is a re-issue of the original work, but has added illustrations of the Harp from Ur *in situ* and restored 1928, and of the Trumpet from the tomb of King Tut-Ankh-Amen discovered 1926.

**THE NATIONAL MUSIC OF THE WORLD.** By H. F. Chorley. Edited by H. G. Hewlett. Many Musical Illus. New issue, with Index. Crown 8vo, cloth, 6s. 6d.

**SOME ASPECTS OF CHINESE MUSIC AND SOME THOUGHTS AND IMPRESSIONS ON ART PRINCIPLES IN MUSIC.** By G. P. Green. Post 8vo, cloth, 3s. 6d.; paper covers, 2s.

**REEVES' DICTIONARY OF MUSICAL BIOGRAPHY.** Noteworthy Men and Women of the Past and the Present (about 2,500). Edited by Edmondstoune Duncan and Others. Crown 8vo, cloth, 4s.; paper covers, 2s. 6d.

**HARP** (The Story of). By W. H. G. FLOOD, Mus.Doc. Twenty-two Chapters. Frontispiece and 32 Illustrations of Instruments, etc. Appendix containing: The Æolian Harp; Epochs in Harp Making and Bibliography. Crown 8vo, cloth, 5s. 6d.

**VIOLINIST'S ENCYCLOPÆDIC DICTIONARY.** Containing the Explanation of about 4,000 Words, Phrases, Signs, References, etc., Foreign, as well as English, used in the Study of the Violin, and also by String Players generally. By F. B. EMERY, M.A New and enlarged edition, doubled in size. 246 pp., crown 8vo, cloth, 7s. 6d.; paper covers, 5s. 6d.; or on India paper and bound in red pegamoid rounded corners, 6s. 6d., suitable for student or travel.

**THE VIOLIN, ITS HISTORY AND CONSTRUCTION.** Illustrated and Described from all Sources. Together with a List of Tyrolese and Italian Makers. With 29 Illustrations and Folding Examples of the First Music issued for the Lute, Viol and Voice. From the German of ABELE and NIEDERHEITMANN. By J. BROADHOUSE. Fresh issue printed in larger size. Cr. 8vo, cloth, 4s. 6d.; paper, 3s.

**STORY OF INDIAN MUSIC AND ITS INSTRUMENTS.** A Study of the Present and a Record of the Past. Together with Sir William Jones' celebrated Treatise in full. With 19 Plates, chiefly of Instruments, 7 Music Illustrations and a Map. By ETHEL ROSENTHAL, A.R.C.M., F.R.G.S. Crown 8vo, cloth, 7s. 6d.

**ART OF ORGAN ACCOMPANIMENT IN THE CHURCH SERVICES.** What to Do and what to Avoid: being a Guide to the Organist in the effective rendering of the Music. By WALTER L. TWINNING, F.R.C.O., *author of* "Examination Test Questions," etc. Cloth, 3s. 6d.; paper covers, 2s. 4d.

**BORODIN THE COMPOSER AND HIS MUSIC.** A Descriptive and Critical Analysis of his Works and a Study of his Value as an Art Force. With many references to the Russian Kouchka Circle of Five—Balakirev, Moussorgsky, César Cui and Rimsky-Korsakov, with Borodin. By G. E. H. ABRAHAM. With Portraits. Thick crown 8vo, cloth, 7s. 6d.

**21 COMPOSITIONS BY THREE FAMOUS SIXTEENTH AND SEVENTEENTH CENTURY MASTERS**, William Byrd, Dr. John Bull and Orlando Gibbons, being Parthenia, or the First Musick ever printed for the Virginals. Arranged for the Piano and freed from the errors of Dr. Rimbault's edition by accurate comparison with the original text by MARGARET H. GLYN (*author of* "Elizabethan Virginal Music and Composers"). Folio, 12s. 6d. (boards, cloth back, 15s.).

**MOZART, WEBER AND WAGNER**, and Various other Essays on Musical Subjects. By Hector Berlioz. Englished by Edwin Evans, Senior, F.R.C.O. Crown 8vo, cloth, 5s. 6d.

**STORY OF NOTATION.** By C. F. Abdy-Williams, M.A., Mus.Bac. Origin and Development. Rare and Curious Examples, Frontis., 4 Illus. and 19 of Instruments. Glossary and Chronological Table of Notation. Cloth, 5s. 6d.

**SOME ASPECTS OF GIPSY MUSIC.** By D. C. Parker. Post 8vo, cloth, 3s. (or paper covers, 1s. 6d.).

**BAGPIPE** (The Story of). By W. H. G. Flood. Twenty-five Chapters of Historical Interest. Frontispiece and 25 Illustrations, Musical Examples. Chronological List of Pipers of all Ages; Glossary of Terms and Pipe Mechanism; Composers who have employed Pipe Music; Bibliography; Pipe Bands of the British Army and O'Farrell's "Treatise on the Irish Bagpipe." Cr. 8vo, cloth, 5s. 6d.

**FLUTE** (The Story of). By H. M. Fitzgibbon, M.A. Nineteen Chapters on Flutes, Flute Players and Music. 49 Musical Examples, 45 Illustrations (Instruments and Portraits). Early Instruction Books, Particulars of Wooden and Metal Flutes and Bibliography. Enlarged edition, 1929, with additional matter, including new Frontispiece—Lulli and his Flautists. Crown 8vo, cloth, 6s. 6d.

The new frontispiece consists of Lulli, the two Hotteterres and M. la Barré also Marais, the violoncellist, with their instruments.

**ORGAN** (The Story of). By C. F. Abdy-Williams, M.A., Mus.Bac. Told in Nine Chapters. Thirty-eight Illustrations and a Frontispiece. Illustrations of Two Instruments found at Pompeii; F. W. Galpin's Hydraulus; Organ Builders; Stops; Technical Terms; Bibliography and Chronological List of Organ Specifications. Crown 8vo, cloth, 5s. 6d.

**TECHNICS OF ORGAN TEACHING.** A Handbook which treats of Special Points in Organ Teaching Examinations, together with Test Questions. By R. A. Jevons. Cloth, 4s.; paper, 2s. 6d.

**VIOLIN** (The Story of). By Paul Stoeving. Forty-four Chapters. Frontispiece and 42 Illustrations of Instruments, Musical Autographs and Portraits. With Appendix. Crown 8vo, cloth, 5s. 6d.

---

Catalogues issued by William Reeves Bookseller Ltd.

| | |
|---|---|
| Full List of Musical Books .......... ......... | Catalogue B |
| Art and General .................................... | Catalogue A |
| Music .................................................. | Catalogue C |
| Masonic Works ....................................... | Catalogue E |

100/1/35

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

ML
552
B76

Music

**TH**

B

**SOME**
Mak
Germ
8vo, c

**MODERN ORGAN TUNING**, The How and Why, Clearl
ing the Nature of the Organ Pipe and the Systen
Temperament, together with an Historic Record of
tion of the Diatonic Scale from the Greek Tetra
HERMANN SMITH. Crown 8vo, cloth, 5s. *net*.

"The greatest authority on acoustical matters connected w
pipes who has ever lived," says Mr. G. A. Audsley of Herma
in his "Art of Organ Building."

**ANALYSIS OF MENDELSSOHN'S ORGAN WORKS.**
their Structural Features. For the Use of Stu
JOSEPH W. G. HATHAWAY, Mus.B. Oxon. 127 Mu
ples. Portrait and Facsimiles. Crown 8vo, cloth,

**RINK'S PRACTICAL ORGAN SCHOOL.** A New Editio
Revised. The Pedal Part printed on a Separate S
Preface, Remarks and Technical Terms translat
German expressly for this Edition by JOHN HIL
Books Complete, bound in red cloth, ob. folio, 20s.
six parts at 3s. *net* each; parts sold separately.

The best edition ever published of this Grand Classical Work
graved, well printed and well edited. A special merit of this
that the *bar lines* are bold, and that they are drawn *right th*
*score*, instead of through each staff, as was the custom in days
As a royal road to thorough and sound Organ Playing in all st
is no other School which will bear comparison with this: a Beg
follow no better course than to go through it slowly.

**THE ORGAN PARTS OF MENDELSSOHN'S ORATO**
**OTHER CHORAL WORKS.** Analytically Considere
LANDO A. MANSFIELD, Mus.Doc., F.R.C.O. With
Musical Examples. Crown 8vo, cloth, 5s. 6d. *net*.

**HENRY SMART'S ORGAN COMPOSITIONS ANALY**
J. BROADHOUSE. Crown 8vo, cloth, 3s. 6d. *net*.

**THE I**
B
2s

**REF**

**TU**